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## Factor White Paper

### EXECUTIVE SUMMARY

Smart Beta portfolio products have garnered much attention recently. These products are generally defined as portfolios purposefully exposed to a given fundamental factor. Given the interest in Smart Beta we want to share research we have conducted into the impact fundamental factors have on stock prices. By fundamental factors, we mean data items describing some aspect of a stock, such as its price to earnings ratio, earnings growth or dividend yield.

This paper illustrates the effectiveness of several fundamental factors in generating investment risk and returns. For each of a number of common investment styles, we show two factors representative of that given style. As would be expected, over the long run, stocks characterized by having good factors outperform stocks with bad factors. For example, stocks with the best (low) price to earnings ratios outperform stocks with the worst (high) Price to earnings ratios. However, in short periods, such as during the global financial crisis and during the most recent few quarters, long run factor effectiveness has not persisted. This paper makes several valuable recommendations, such as:

- ▶ Even good, intuitive factors carry potential volatility and, of great importance, significant propensity to go through bouts of underperformance. Hence:
  - Patience is required.
  - Smart Beta exposures should be diversified. Don't 'bet' on one factor.
- ▶ Factor analysis conveys important performance and risk attribution information and adds value when combined with traditional attribution approaches.
- ▶ Sell disciplines which rid portfolios of poor factor exposures, whether such exposures are intended or unintended, are an effective way of reducing portfolio risk.
- ▶ Factor analysis provides a valuable tool allowing managers to adapt their models and strategies either by changing their emphasis on a particular factor or through rotation of factors and/or styles.



## HOW TESTING WAS CONDUCTED

**Database:** Morningstar’s CPMS Equity database allows several hundred factors to be tested. We tested dozens of factors on as many as 500 stocks. All of our testing was conducted in subsets of the overall universe, as described below.

**Quintile testing:** For each factor tested, we ran quintile tests. Our quintile tests adhere to a specific protocol where, for every month in the test period, stocks are sorted (best to worst) on a given factor, say dividend yield. Once sorted, stocks are grouped into buckets representing 20% of the universe of stocks tested that month. Applying stock price returns for the following month allows us to calculate how each quintile performed in any period. This process is then repeated for the next factor, until all quintiles for all factors for all periods have been processed.

For each factor, Quintile 1 represents stocks with the “Best” factor values and Quintile 5 represents stocks with the “Worst” factor values. Thus, Price to Earnings is sorted from lowest to highest because the top quintile is the best. Conversely, earnings growth is sorted from highest to lowest as more growth is preferred to less.

**Testing Universe:** This paper concentrates on quintile tests we conducted within the roughly 500 largest companies in Canada. Outside the scope of this paper, we also ran quintile tests on subsets of this universe such as the TSX 60 constituents, the largest 100 stocks in Canada and a small cap universe consisting of the smallest 400 stocks of the 500 stock test universe.

**Time Periods tested:** We ran our tests from January 1999 onward. We have tested back as far as 1985. However, for this analysis we chose 1999 because data were not available, prior to this date, for a small but important group of factors. We broke the test period into several sub-periods, as follows:

Time Period	Rationale for use
1999 – 2015	We tested through to the most recent date to examine long term factor effectiveness.
1999 – 2013	We ended this sub-period at 2013 to allow for a comparison between longer term and recent results.
1999 - 2007	This time period represents the first half of the longer term period tested, that time period <u>before</u> the global financial crisis.
2007 - 2009	This period represents the bulk of the global financial crisis and subsequent market rally.
2009- 2013	This time period represents the second half of the longer term period tested, that time period <u>after</u> the global financial crisis.
2013 -2015	We isolated this period to illustrate recent results.



## **HOW FACTORS WERE CHOSEN**

Today, data are available for hundreds of factors. We avoid testing all available factors as doing so is, to us, the epitome of data mining. Instead, before testing we judge factors on their intuitive appeal using our collective experience as fundamental analysts and portfolio managers regarding what drives stock prices. Our intuition on a factor's effectiveness and usefulness is shaped by our belief that a stock's current price should be a reflection of a company's expected future cash flows discounted back to the present day. We look for factors that suggest either future cash flows might be higher (or lower) and/or that the discount rate should be lower (or higher). It is intuitively appealing to link growth (in sales, dividends or earnings) to rising future cash flows. Therefore, factors which indicate future growth of cash flows are ripe for testing.

Similarly, certain factors intuitively could be demonstrated to lower the discount rate used. Factors indicating an improvement in balance sheet strength, quality of governance, earnings stability, yield or valuation levels are of interest. If a factor cannot be tied back to having an impact on the discounted cash flow calculation then, to us, it shouldn't be a relevant factor.

Our intuitive approach is our first defence against data mining. Consequently, while several hundred factors exist we are not going to use those that do not pass our intuition test. We are often asked what research efforts we are placing in finding new factors. We find this question to be misplaced. The real question should not be "are there any new factors" but rather "are there any new intuitions"? We doubt that CEOs today are managing their companies using different key performance indicators versus those used 20, 30 or 50 years ago. Similarly, we have not heard of any new investment styles being created in the past decade. Surely these two signposts would be indicators of new intuitions.

## **TEST RESULTS**

Chart 1 depicts our factor results for the entire test period. The first two columns in Chart 1 show the style category and the factors we chose to act as proxies for each style. The results were broken down by quintile, grouping Quintile 1 (the best of a factor) separately from Quintile 5 for a factor. The graphics in the risk column depict the amount of volatility experienced due to exposure to the factor. Green bars to the left of the vertical axis indicate a lower level of volatility versus the TSX Total Return Index (TSX). Red bars to the right indicate greater than market volatility levels.

In the next column, returns net of the TSX (Net Return) are shown graphically. Red bars indicate lower than market levels of return. Green bars illustrate outperformance. We show risk and return numbers graphically as we want to convey direction without implying precision as to the magnitude. Keep in mind that quintile tests are backtests. Return and risk outcomes should be considered as to their direction and strength but not as to the precision of their magnitude.

The final column shows the factors' rank. To calculate this value we ranked all factor quintile returns that we tested (over 100 factors times 5 quintiles) on Net Return. The factor quintile generating the highest Net Return scored a rank of 100; the lowest Net Return scored 0. We used Rank as a means of



evaluating the long run effectiveness of a factor because we wanted to understand a factor's effectiveness relative to all other factors we tested and not just for its propensity to beat the market.

Chart 1 shows the long term impact of Quintile 1 vs. Quintile 5 factor exposures. We observe that Quintile 1 factors:

- ▶ Show a propensity to outperform the TSX.
- ▶ Have a history of being among the most effective of all factors in generating Net Return.
- ▶ Carry greater volatility than the TSX in most instances. This is not universally true as Dividend factors carried less volatility. Greater volatility, in general, could be explained as Quintile 1 is a more concentrated portfolio than the TSX.
- ▶ Show effectiveness in all Style Categories.
- ▶ Beat Quintile 5 factors on risk and return measures for 100% of the factors shown.

From the long term period tested it would appear there is merit in the recent popularity of Smart Beta. Caveats to exploiting the factors illustrated above would include:

- ▶ Winning quintiles tend to carry more volatility than a passive strategy.
- ▶ Resulting portfolios could provide large unconstrained sector weight exposures, a market cap bias or turnover levels that investors might not want to replicate in real life.
- ▶ Introducing many unintended factor exposures to one's portfolio.



# Chart 1 - Long Term Results

## Factor Performance Analysis

			Long Term	
			Start Date	End Date
Quintile 1: "Best"			199901	201504
Category	Description	Risk	Net Rtn	RANK
Dividends	Dividend Growth			89%
Dividends	Yield			83%
Estimates	Earnings Surprise			96%
Estimates	Estimate Revision			97%
Growth	Cash Flow Growth			89%
Growth	Earnings Growth			77%
Quality	Reinvestment Rate			87%
Quality	Return on Equity			93%
Momentum	Short term Price Change			97%
Momentum	Long Term Price Change			96%
Value	Earnings Yield			91%
Value	Expected Earnings Yield			83%

Quintile 5: "Worst"			Net Rtn	RANK
Category	Description	Risk		
Dividends	Dividend Growth			28%
Dividends	Yield			14%
Estimates	Earnings Surprise			7%
Estimates	Estimate Revision			5%
Growth	Cash Flow Growth			17%
Growth	Earnings Growth			12%
Momentum	Short Term Price Change			3%
Momentum	Long Term Price Change			2%
Quality	Reinvestment Rate			8%
Quality	Return on Equity			4%
Value	Earnings Yield			4%
Value	Expected Earnings Yield			6%



To highlight risks associated with Smart Beta, let's review recent factor effectiveness. Chart 2 depicts the long term results, presented above, but broken down into two sub-periods. We purposely chose to end the first sub-period at the end of 2013 because 2013 was an excellent year for factor performance and hence, active management. ([See 18 AM Active Management Analysis paper](#)). In Chart 2, we compare the last 16 months to the longer run results.

Observations include:

- ▶ Results ending 2013 are very similar to the long term results for both Quintiles 1 & 5.
- ▶ In the last 16 months, Quintile 1 factors:
  - Have mostly underperformed versus the TSX. Quintile 1 factors that were able to score a rank in excess of 90% did outperform the TSX but only barely as evidenced by the size of the green bars.
  - Ranked in the bottom half of all factor ranks. The average rank of Quintile 1 in the recent period had dropped to 53% from 91% in the period ending 2013.

It is evident that good factors currently have not been working very well and are not the driving force behind returns. There are several possible explanations for the recent poor factor performance:

- ▶ Nothing works all the time: no style, no strategy, no factor.
  - Short term deviation from long term trends is possible and is to be expected.
  - Smart Beta is not risk-free and requires a patient, long term view by investors.
- ▶ Over short periods, small subsets of stocks can have profound effects on the performance of a given quintile. For instance:
  - Energy stocks would have had a large impact given their rapid rise in the first half of 2014, their collapse in the second half of 2014 and big gains in 2015 for a select few.
  - Individual stocks such as Valeant and Constellation, whose unusually large gains would positively affect the returns of any quintile in which they were held.
- ▶ Everyone is trying to exploit the same factors at the same time. This argument gained credence in August of 2007 when a very brief but violent correction of prices occurred in US Equities. The correction was linked to several investment managers exploiting a very similar strategy. ([See Khandani and Lo, 2007](#)). At the core of this situation is the following chain of events a) a factor gains popularity through academic publication or other means, b) numerous investors start to look for stocks exhibiting this factor (i.e. they all start to exploit the factor), c) the factor, due to its overuse in investment models, ceases to be effective, d) investors quit using the factor and e) as the factor becomes neglected, its effectiveness re-



emerges. Past examples of this situation have been repeated for factors such as earnings surprise and estimate revision. The jury is out as to whether Low Volatility strategies are a repetition of this situation.

- ▶ The loss of effectiveness due to the overuse of a given factor is not restricted solely to quantitative investment managers. While overuse of a factor is a credible argument for a factor losing its effectiveness, it would not appear to be the rationale for the current situation as it is not one factor but ALL factors that have lost their effectiveness in the past 16 months.

## Chart 2 - Short Term Results

<b>Factor Performance Analysis</b>		To end of 2013		Last 16 Months	
		Start Date	End Date	Start Date	End Date
Quintile 1: "Best"		199901	201312	201312	201504
Category	Description	Net Rtn	RANK	Net Rtn	RANK
Dividends	Dividend Growth		86%		96%
Dividends	Yield		89%		19%
Estimates	Earnings Surprise		96%		63%
Estimates	Estimate Revision		96%		58%
Growth	Cash Flow Growth		91%		45%
Growth	Earnings Growth		87%		7%
Quality	Reinvestment Rate		83%		93%
Quality	Return on Equity		93%		94%
Momentum	Short term Price Change		98%		31%
Momentum	Long Term Price Change		97%		15%
Value	Earnings Yield		91%		83%
Value	Expected Earnings Yield		87%		28%

Quintile 5: "Worst"		Net Rtn	RANK	Net Rtn	RANK
Dividends	Dividend Growth		31%		8%
Dividends	Yield		14%		18%
Estimates	Earnings Surprise		7%		19%
Estimates	Estimate Revision		5%		8%
Growth	Cash Flow Growth		16%		76%
Growth	Earnings Growth		11%		30%
Momentum	Short Term Price Change		2%		44%
Momentum	Long Term Price Change		1%		45%
Quality	Reinvestment Rate		9%		4%
Quality	Return on Equity		4%		11%
Value	Earnings Yield		4%		10%
Value	Expected Earnings Yield		5%		52%



Given the current poor short term performance, it would be normal to question whether factors will ever regain their effectiveness. To shed some light on this topic let's examine another historical period.

Chart 3 illustrates factor returns before, during and after the Global Financial Crisis.

### Chart 3 - Global Financial Crisis

<b>Factor Performance Analysis</b>		<b>Pre-Crisis</b>		<b>Crisis</b>		<b>Post Crisis</b>	
		Start Date	End Date	Start Date	End Date	Start Date	End Date
<b>Quintile 1: "Best"</b>		199901	200712	200712	200912	200912	201312
Category	Description	Net Rtn	RANK	Net Rtn	RANK	Net Rtn	RANK
Dividends	Dividend Growth		84%		50%		81%
Dividends	Yield		69%		88%		88%
Estimates	Earnings Surprise		95%		53%		84%
Estimates	Estimate Revision		98%		79%		54%
Growth	Cash Flow Growth		90%		18%		90%
Growth	Earnings Growth		92%		4%		84%
Quality	Reinvestment Rate		87%		7%		92%
Quality	Return on Equity		91%		27%		93%
Momentum	Short term Price Change		97%		95%		62%
Momentum	Long Term Price Change		99%		2%		89%
Value	Earnings Yield		85%		68%		86%
Value	Expected Earnings Yield		94%		10%		62%
<b>Quintile 5: "Worst"</b>							
Category	Description	Net Rtn	RANK	Net Rtn	RANK	Net Rtn	RANK
Dividends	Dividend Growth		33%		42%		37%
Dividends	Yield		21%		26%		10%
Estimates	Earnings Surprise		4%		53%		19%
Estimates	Estimate Revision		4%		52%		9%
Growth	Cash Flow Growth		11%		94%		29%
Growth	Earnings Growth		9%		65%		17%
Momentum	Short Term Price Change		2%		5%		6%
Momentum	Long Term Price Change		0%		87%		4%
Quality	Reinvestment Rate		11%		64%		7%
Quality	Return on Equity		8%		29%		2%
Value	Earnings Yield		5%		58%		3%
Value	Expected Earnings Yield		6%		91%		2%

For this Chart, three time periods are presented:

- ▶ In the Pre-Crisis column, Quintile 1 & 5 factors experienced similar outcomes to the long term results, illustrated in Chart 1. In other words, before the crisis, factors were working as expected. Pre-Crisis Quintile 1's average rank was 90%. Quintile 1 beat Quintile 5 as to risk and return.
- ▶ During the Crisis, most Quintile 1 factors declined in their effectiveness. Quintile 1's average rank of 42% is worse than during the last 16 months shown in Chart 2 of 53%. While Quintile 1 wasn't working, counterintuitively Quintile 5 started



working, as shown by the green bars and a universal increase in Quintile 5 ranks versus all other periods.

- ▶ In the Post-Crisis period, the effectiveness of Quintile 1 factors has returned, with the average ranking (of 80%) approaching previously held levels. This average ranking is below the 90% experienced pre-crisis but is still respectable for a short time period (4 years) and as the green bars indicate outperformance returned.

As shown in Chart 3, factor effectiveness can deviate from long term trends, sometimes substantially, over short time periods. However, factors with intuitive appeal do have a tendency (and a rationale) for reverting back toward longer term trends. Consequently, we are confident that the current experience of factor effectiveness will revert back toward the long term (and intuitive) trend. Intuitive factors provide the basis for all fundamentally-oriented investment strategies.

## **CONCLUSIONS**

To conclude, we present the implications of our analysis.

For Smart Beta investors:

- ▶ Even good, intuitive factors carry substantial potential volatility and of great importance, significant propensity to go through bouts of underperformance. Hence:
  - Patience is required.
  - Smart Beta exposures should be diversified. Don't 'bet' on one factor.
- ▶ Understand your exposures. If you are following a Smart Beta benchmark, understand how it is constructed. You may be getting some undesirable, unintended exposures.

For Active Managers:

- ▶ Factor analysis conveys important performance and risk attribution information. Adding factor attribution to the traditional approach of looking at the attribution of stocks and sectors adds value.
- ▶ Individual factors carry considerable risk. Therefore, factor diversification within an investment model is imperative.
- ▶ Sell disciplines for ridding portfolios of Quintile 5 exposure, whether such exposures are intended or unintended, reduce risk.
- ▶ Factor analysis underscores the importance of providing clients with style (and not just factor) diversified portfolios.
- ▶ Factor analysis is a valuable tool allowing managers to adapt their models and strategies either by changing their emphasis on a particular factor or through rotation of factors and/or styles.



For Clients and Consultants:

- ▶ Understanding long and short term factor performance and propensities helps in the assessment of how certain styles and style-adhering managers are (or should be) doing.
- ▶ Factor analysis conveys important performance and risk attribution information. Adding factor attribution to the traditional approach of looking at stocks and sectors adds value.
- ▶ Factor analysis underscores the importance of providing clients with style (and not just factor) diversified portfolios.
- ▶ Factor analysis provides valuable insights into the creation of style diversified client portfolios. The old 50:50 mix of Value and Growth may no longer be optimal.

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