Winning the Loser's Game: Factor Investing Can Help Avoid Losers, But Not Select Winners
September 2016 (revised October 2017)

By: Maneesh Shanbhag, CFA, Chief Investment Officer

Executive summary

- Recognizing that markets are a "Loser's Game" means minimizing mistakes should be a more successful strategy than attempting to select winners
- Equity "Smart Beta" factors are mostly priced into markets and therefore should offer little opportunity for outperformance
- Value and Momentum metrics appear more successful at selecting securities compared to other smart beta factors
- Quality, Volatility, and Price Reversal metrics tend to be priced into markets but at their extremes may be useful for avoiding potential poor performers, which concurs with a Loser's Game
- Many smart beta factors overlap with each other in screening out the most speculative stocks

Introduction

"It is remarkable how much long-term advantage people like us have gotten by trying to be consistently not stupid, instead of trying to be very intelligent."

- Charlie Munger

The right strategy for winning any game requires first understanding the competitive dynamics of the game. One model is that of a "Winner's Game" versus a "Loser's Game". A winner's game is one where the outcome is determined by the actions of the winner. The most common example used is professional tennis where the winner is usually the one who hits the most winning shots. In contrast a loser's game is one where the outcome is determined more so by the actions of the loser. Again, in tennis, the amateur game is one where the winner is often the one who commits the *fewest* unforced errors. In a 1975 paper in the Financial Analysts Journal, Charlie Ellis called investment management a loser's game[1]. Professional money managers compete with one another using similar data and analytical models. There is no easy money to be made as these professionals keep markets efficient enough. As a result, the best investors tend to be the ones who make the fewest mistakes, not necessarily the ones who hit the most homeruns. ***In a Loser's Game, the right strategy is to avoid making mistakes***, ***rather than trying to score (identify) the big winners.***

Markets are efficient *enough*, most of the time, is another way to sum up the loser's game. At the very least, making this assumption as our starting point, saves us a lot of pain from poor selection. In contrast, so called "smart" beta strategies, such as high dividend yield or low valuation equity strategies, claim the ability to outperform market averages by screening based on simple quantitative metrics. We think the loser's game market dynamic is at odds with this claim.

[1] Ellis, C. (July/Aug 1975). Loser's Game. *Financial Analysts Journal*, 19-26.

Our research for this paper shows that smart beta factors are mostly priced into markets, but have some utility as a screen to avoid poor performers. We studied 15 quantitative metrics, grouped into four broad buckets of Value, Quality, Momentum and Volatility based measures. While there are claims to the existence of hundreds of risk factors, a growing body of research shows that most are spurious results of data mining or overlap with the four broad risk factors we have used. All of our data is from the Ken French Data Library and each metric we studied had at least 52 years of monthly data with some having over 90 years and going back as far as July 1926. The table below summarizes the metrics we studied and how we grouped them by bucket. Note that while the size factor should be its own unique category, we grouped it with valuation factors for convenience and because value metrics do exhibit some size bias.

Risk Factor	Metrics Studied
Valuation	Size, Dividend Yield, Price-to-Book, Price-to-Earnings, Price-to-Cash Flow
Momentum	2-12 month Momentum, 1 month Price Reversal, 60 month Price Reversal
Quality	Profitability, Accruals, Investment Growth, Net Share Issuance
Volatility	12 month Volatility, 60 month Beta, 12 month Excess Volatility

We analyze each group of factors for whether they demonstrate any ability to differentiate between high returning and low returning equities, in essence whether the factor is priced into markets.

Value Beats Growth, And Value Historically Provided a Tailwind to Smallcap

Quantitative methods for stock selection have been around for decades. As early as 1976, the father of value investing, Ben Graham, published a formula for selecting cheap stocks that should outperform[2]. The most commonly used valuation metrics for quantitative models are price-to-book, price-to-earnings, and price-to-cash flow ratios. Lower ratios are meant to signal cheaper prices and therefore higher future returns. However, if we start from a perspective of market efficiency, lower valuation ratios should only imply lower expected growth rates (in sales, earnings, cash flows, etc.) rather than mispriced securities offering higher expected returns.

In reality, there has been a demonstrable bias for lower valuation stocks to outperform those with higher valuations. Some of this bias is likely driven by behavioral factors, such as the propensity to gamble and buy lottery tickets (like a high flying, small cap growth stock), which would drive, on average, overvaluation of speculative stocks. As is only natural in a competitive, capitalist economy, the growth rates of these high flyers tend to revert toward the mean, resulting in falling valuation ratios and lower returns. Since behavioral biases tend to be permanent due to human nature, it is reasonable to expect this lottery ticket anomaly to persist.

In our study on valuation metrics, we divided the universe of US stocks (using a set similar to the Russell 3000) into 10 equal-weighted buckets, ranked from most expensive to cheapest for each valuation ratio. Each metric studied is the inverse of a traditional valuation ratio, that is we sorted the universe by book-to-

[2] Medical Economics, Sept 20, 1976. “The Simplest Way to Select Bargain Stocks”, Benjamin Graham, http://www.rbcpa.com/simple-and-easy-approach-medical-economics-graham-1976.pdf

market instead of P/B and similarly for P/E and P/CF. Companies with the highest valuations are in the “Lo” or first bucket and the lowest valuation ratios in the “Hi” or tenth bucket.

The charts below on the left side of the page show returns, while those on the right side show the Sharpe ratio for each valuation measure and are based on underlying data from 1951-2015. From looking only at returns, it would appear that these simple valuation measures are not priced into the market and show consistent improvement as one goes from the most “expensive” to “cheapest” buckets, left to right. But risk-adjusted return, as measured by Sharpe ratio, tells a different story. From the charts showing this ratio, we can see a leveling off in the benefit from selecting ”cheaper” stocks. ***Said another way, there appears to be a greater benefit from avoiding highest valuation equities than selecting those with the lowest valuation.*** We specifically highlight in red the buckets where the returns and ratios deviate materially from the average. These are all the highest valuation buckets. Each valuation ratio shows the same pattern, that they are more effective at avoiding poor performers than selecting top performers.

Note, companies with the highest valuations are in the “Lo” bucket, for low book-to-market and so on and vice versa in the “Hi” bucket. Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1951-Dec 2015.

We think it is logical that high valuations tend to overestimate future growth, more so than low valuations underestimate growth. When companies and industries grow at fast rates markets tend to expect this growth to continue for many years to come and valuations rise accordingly. The rapid growth attracts competition and capital as is natural in capitalism. Competition not only slows growth but also erodes profit margins dramatically reducing earnings growth. As markets price in this competitive dynamic, usually after growth rates slow, valuations fall, resulting in low returns. Technology companies in the late 1990's are a prime example of extremely high valuations leading to low returns after competition eroded their potential given the few, low barriers to entry for most. Some businesses undoubtedly achieve rapid growth over long periods of time and deliver on high expectations, but the losses from investing in those who fail to achieve this expected growth are large.

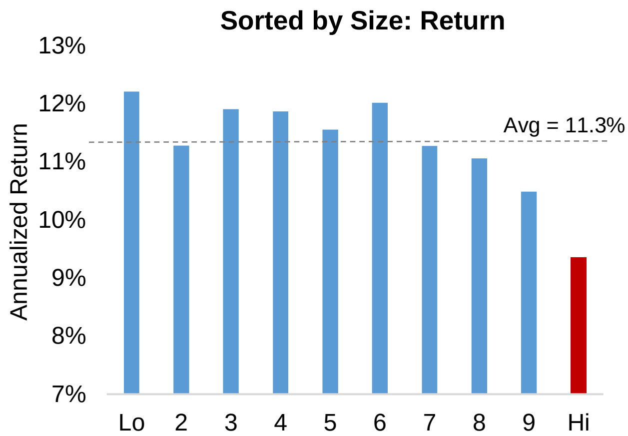
We quantify the advantage of eliminating the worst performers compared to selecting the top performers below. The table compares the improvement in Sharpe ratio from selecting the "cheapest" 10% of stocks compared to the average against the improvement from avoiding the 10% most "expensive" stocks. ***We can see that the improvement in performance from eliminating the worst has been over 4 times as great as from selecting the best.*** In technical terms, the benefits from selecting the cheapest equities is not statistically significant, while avoiding the most expensive is.

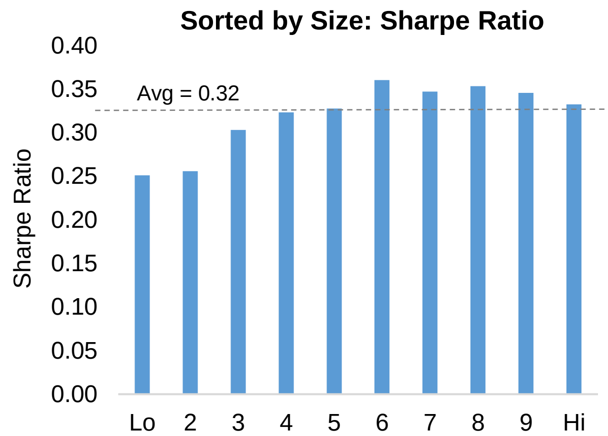
Sharpe Ratio Improvement	**"Cheapest" 10% minus Midpoint**	**Midpoint minus "Expensive" 10%**
Book-to-Market	0.11	0.51
Earnings-to-Price	0.12	0.41
Cash Flow-to-Price	0.10	0.45
Average	**0.11**	**0.46**

Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1951-Dec 2015.

We generally avoid relying on volatility and Sharpe ratio as measures of risk and risk-adjusted returns because they are not measures of true risk and are easily gamed. But in this case comparing Sharpe ratios across valuation buckets illustrates the concept behind risk-adjusted returns and how the gains from moving to lower valuations are less than linear.

In the above charts, as we move from left to right, absolute returns rise. But by the midpoint of each one, the Sharpe ratios are leveling off indicating that volatility of the underlying stocks is also increasing. There are many reasons why a stock will have higher volatility than others - smaller size and therefore lower earnings stability is one of those reasons. Numerous studies have documented the small cap tilt in value biased investment strategies. To understand the impact of smaller size, similar to the valuation charts above, we sort the market into 10 size buckets. The smallest bucket has an average market capitalization today of ~$100mln (microcap), the middle bucket is ~$2.5bln (smallcap), and the largest averages ~$80bln (mega cap). From the return chart we can see all size buckets earned similar returns historically with a small decrease for large caps (bucket 9) and an almost 2% return reduction for the largest bucket where most investors concentrate their holdings. In the Sharpe ratio chart we see the opposite pattern, that size is largely priced in and each bucket delivers a similar ratio except for the smallest microcap buckets (1 & 2), which have historically earned lower risk-adjusted returns.





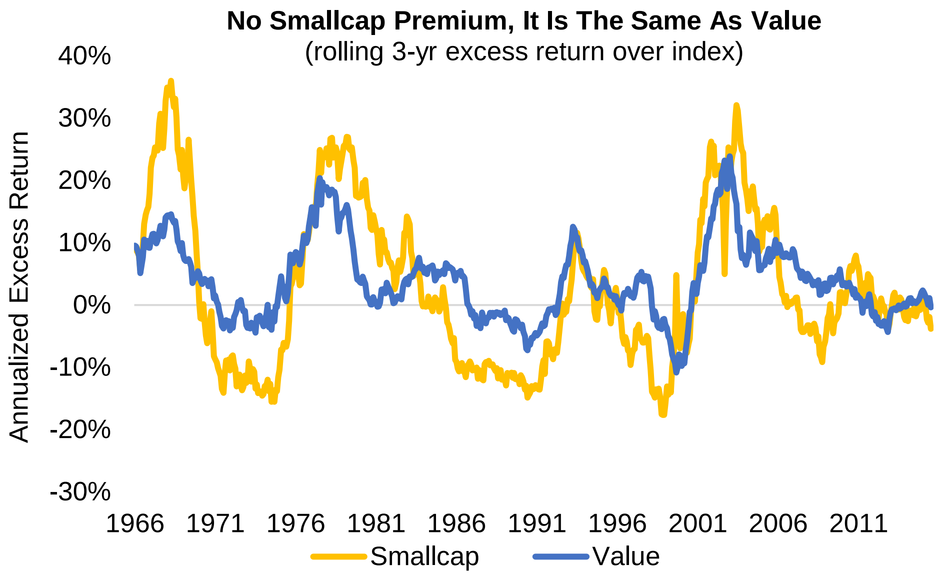
Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1926-Dec 2015.

The 2% additional return from smaller companies is likely driving part of the return premium from lower valuation equities above. It is logical that lower valuations have a bias toward smaller sizes. If I take two companies with the same sales and earnings, and one has a lower P/E ratio, it will have a smaller market capitalization. This does not explain all of the return improvement from selecting low valuation stocks but a significant part of it.

While academic studies point to the smallcap bias in value investing, we flip the question and ask whether the smallcap return premium was driven by their historically lower valuations. ***We think the valuation difference was an important driver suggesting there is not a small cap premium.*** In the 1970's when smallcap investing was first introduced, this segment of the market had few investors as the companies were considered speculative and had less research coverage and available data. Today, it would be rare to find an institution or individual investor without an allocation to smallcap equities and there are thousands of hedge funds scouring for the those that might outperform. As any information asymmetry was reduced, the smallcap return premium disappeared. Since 1980, smallcaps have actually underperformed largecaps by almost 2% annually[3]. Today valuations on smallcaps are higher than on the largest companies[4] which could lead to lower returns compared to largecaps in the future as well.

Since there was historically an overlap between low valuation equities and smallcaps we should expect these two styles to have outperformed and underperformed the broad index at the same time. The chart below shows the rolling 3-year excess return of the 2 lowest valuation buckets (low quintile), as defined by earnings-to-price, compared to the excess return of the 2 smallest size buckets (smallest quintile). We can see they both outperform and underperform the broad market at the same time indicating a similar bias. Note that low valuation has lower downside risk and has earned higher absolute returns.

[3] From Jan 1980-Aug 2016, the annualized return of the Russell 2000 was 9.68% compared to 11.52% for the S&P 500.
[4] As of 9/1/16, the P/E on the mega cap Dow Jones Industrial Average was 17.5 versus 27.9 on the small cap Russell 2000



Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1963 – Dec 2015. Index is the S&P 500.

From our study, simple valuation ratios including P/B, P/E, and P/CF are effective for separating out strong performers from poor performers. But the benefits from using these valuation ratios is contrary to popular belief. These metrics are more effective at avoiding poor performers than they are at selecting the best performers. In the Loser's Game of institutional investing, avoiding unforced errors can be more valuable than hitting homeruns.

Since smart beta has grown in popularity in recent years, we use the remainder of this paper to show how the other common smart beta factors perform in security selection, and how some even overlap with the value metrics analyzed above. We will show that the usefulness of most of these smart beta factors is also to help avoid the poor performers. Momentum is the exception in that it has historically been more successful at selecting winners, which we describe next.

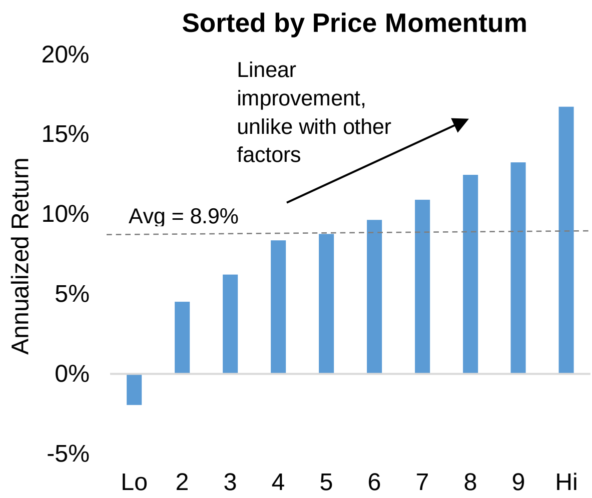
Momentum Works but Is Sensitive to Definition

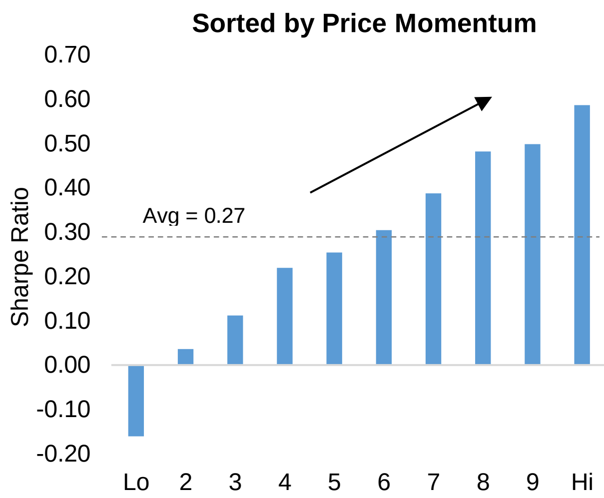
Momentum trading is the buying of securities that have risen in price the fastest, and selling those shares that have been falling in price the most. Like the value factor, momentum is well documented to work across the world and across asset classes.[5] Again, like with value, there are behavioral reasons why it works and therefore why we think it should persist. Investors in aggregate have a tendency to chase past returns. They buy stocks and mutual funds that have gone up, without regard for the power of mean reversion. This buying behavior then pushes up these same securities further in price in the short term. Only over the long term do the underlying fundamentals anchor prices.

As we did with value, we divide up the universe of equities into 10 buckets from low momentum (worst trailing average 2-to-12-month price return relative to the broad market) to high momentum (best trailing 12-month price return relative to the market). The charts below show the return of these buckets as well as Sharpe ratio from Jan 1927-Dec 2015. As we can see, the increasing returns in moving from left (Lo) to right (Hi) suggest that the best performing stocks will continue to perform well in absolute returns and in

[5] Asness, C. S., Moskowitz, T. J., Pedersen, L. H. "Value and Momentum Everywhere", The Journal of Finance, June 2013

risk-adjusted terms. We have also tested momentum at different market capitalizations and find similar results of consistently improving performance as one selects equities with higher past performance.





Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1926-Dec 2015.

Unlike with value, and as we will see with other factors, momentum works better in a linear manner as one moves from right to left in these charts. ***This suggests the best way to use momentum is to select the "best" performers, and sell the "worst" past performers, rather than overdiversifying.*** But momentum is not a holy grail. First, it cannot work forever as security prices should stay connected to underlying fundamentals over the long run in properly functioning capital markets. That is, strong past performers generally revert to the mean after their returns have outperformed their underlying fundamentals such as sales or earnings growth and valuations become too high.

While the concept behind momentum is simple and historical results are good, implementation is nuanced for a few reasons:

1) Momentum is a high turnover strategy and therefore potentially costly to implement,
2) Herding behavior makes this strategy potentially volatile, and
3) Momentum is sensitive to the definition used.

The results for momentum shown above are based on portfolios that are rebalanced on a monthly basis. This requires a lot of costly trading activity. While monthly rebalancing is how value and all of the other factor portfolios in this paper are constructed, some factors like value and quality do not require frequent trading and hence hypothetical results should not be significantly different from actual.

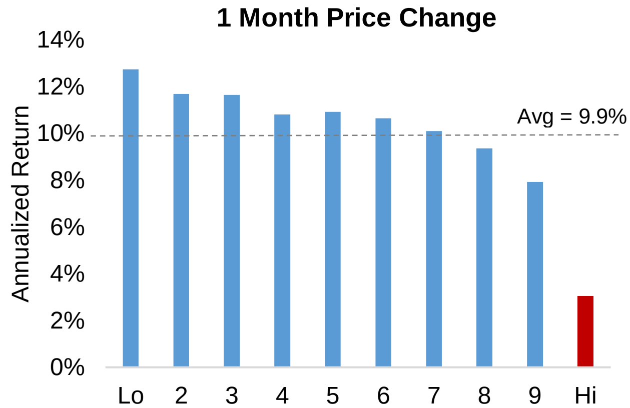
The behavioral reason behind momentum is effectively that success begets more success. High returns cause more investors to pile in. As momentum strategies have become more popular due to their documented success, it should cause more volatility for these strategies as investors chase each other into the same securities and therefore buy and sell at the same time. This will certainly make the strategy riskier, both in terms of volatility experienced but more importantly with the returns that can be achieved. In a world of instantaneous electronic trading, momentum strategies depend on you not being the last one out. This makes implementation rules critical, such as over what period one measures momentum and how long positions are held.

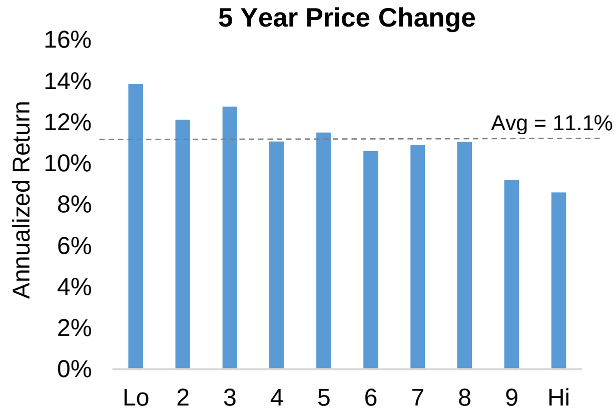
This leads to the most important risk with momentum - it is sensitive to the period over which price return is measured. And this should only become more so as investors increasingly copy the same strategies. Momentum has been shown to only persist for four to eight months in individual stocks.[6] That is, after this period of time, the outperformance by past strong performance is reduced to zero or worse mean reverts to negative. A poorly constructed momentum strategy may instead capture this price reversal. And our study of price reversal, below, points to opposite conclusions as shown by momentum indicators.

Price Reversal Strategies are Defined Like Momentum but Behave Like Value Factor

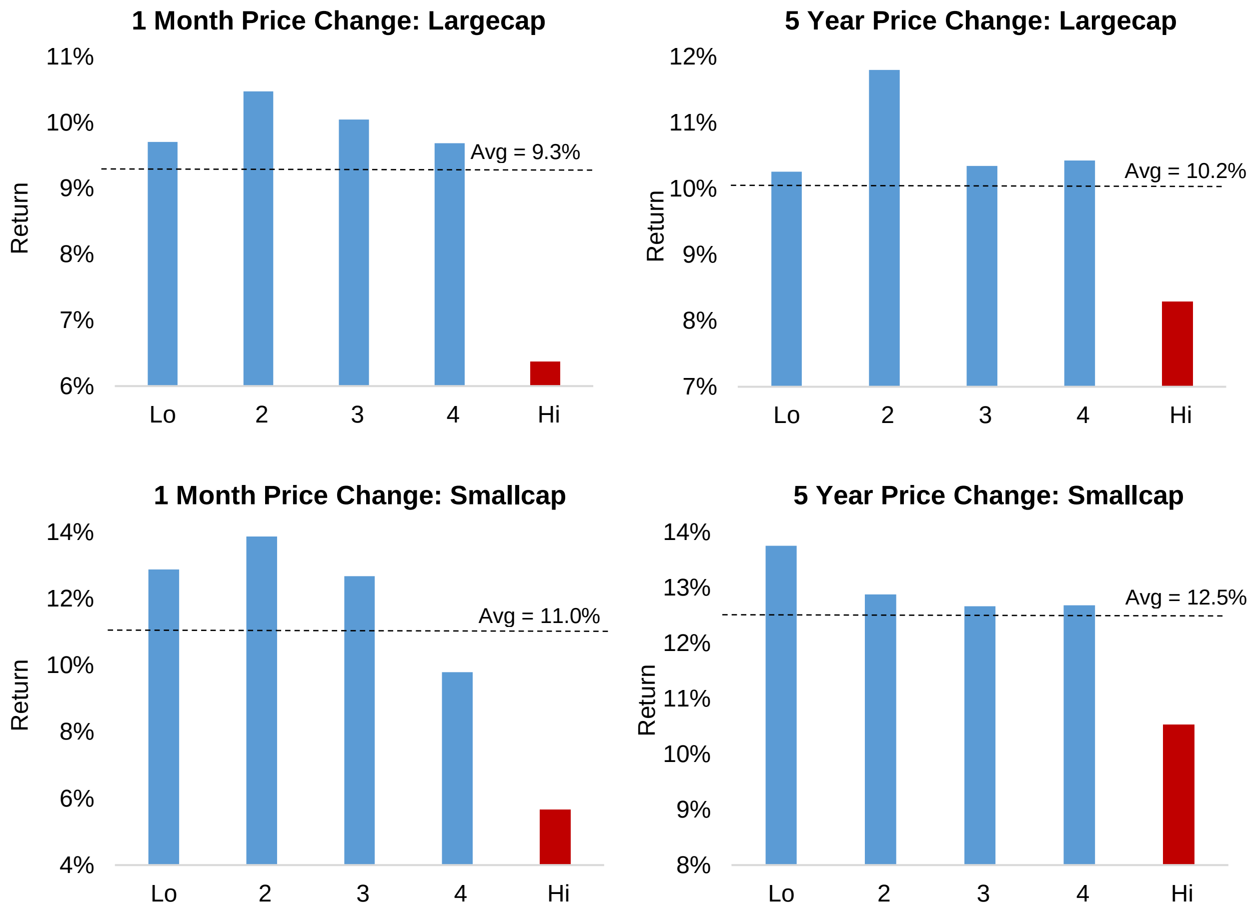
Price reversal strategies are similar to momentum in that they are based only on past price movement. High momentum securities are ones with the best past performance over 2-12 months, and appear to continue this performance into the future. Reversal strategies divide the universe similarly, 'High' being ones with the best past returns and 'Low' having the worst past returns. They are called reversal strategies because securities with high past returns are expected to revert and perform poorly. This may sound confusing as it is at odds with what momentum suggests and it is. We study two definitions of price reversal, a short-term based on past 1-month returns and a long-term strategy based on past 5-year returns, and both studies arrive at similar results that conflict with momentum and point to its risks.

The charts below show the return for short-term and long-term price reversal as measured by 1-month and 60-month price change respectively using data from 1926-2015. We sort the market into ten buckets from lowest historical returns (Lo) to highest (Hi) as well as by size. The first thing we see is that historical price changes are mostly priced in. There are only small return differences in going from the worst historical performers to the best. This is only logical and consistent with what we found with valuation metrics. As price changes drive changes in valuation measures, markets mostly price in these adjustments to expected return. Only at the extreme decile with the highest historical returns are future returns significantly lower than in other buckets. This is consistent with stocks that have the highest valuations.





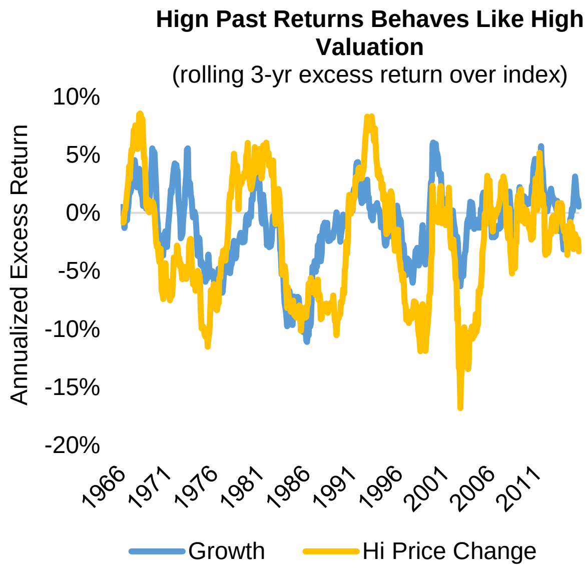
[6] Geczy, C. C., Samonov, M., "Two Centuries of Price-Return Momentum", Financial Analysts Journal, 2016 Vol 72, No. 5

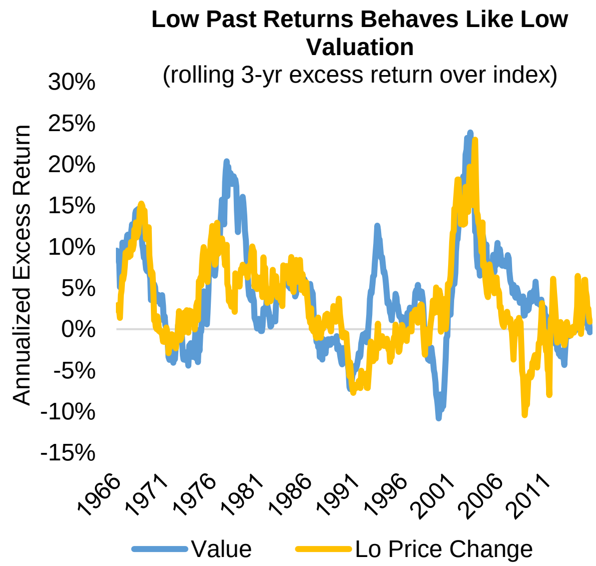


Source: Ken French Data Library, Greenline Partners analysis. Data from Feb 1926 to Dec 2015.

The connection between price reversal factors and value investing is simple to understand. One way a stock becomes "cheap" as measured by common valuation ratios like price-to-earnings, is poor past returns. Since cheap stocks outperform as shown above, stocks with the relatively low historical returns should on average also outperform. The vice versa is also true with stocks.

To show that price reversal and value overlap, the charts below compare the excess return of momentum strategies (based on 1-month price change) over a broad index, versus the excess returns of growth and value to show they are similar. ***As logic would suggest, price reversal and value outperform and underperform at similar times.*** This suggests one should use either valuation or price reversal as a screening factor, but not both simultaneously. We study this question and how it informs portfolio construction near the end of this paper. While we show this comparison based on short-term price reversal only, the pattern is similar for long-term price reversal as well though it is largely priced in as indicated in the charts above.





Source: Ken French Research Data, Greenline Partners analysis. Data from Jul 1963 to Dec 2015. Index is the S&P 500.

The table below provides the summary statistics comparing price reversal to value. Price reversal is not only similar to value, and therefore not diversifying, but also historically underperformed as a screening metric. This suggests that valuation as a factor should be given higher weight in a portfolio construction model if price reversal is used at all.

Jul 1963-Dec 2015	High P/E (Growth)	High Past Return	Low P/E (Value)	Low Past Return
Annual Return	8.6%	6.9%	13.9%	12.6%
Volatility	17.5%	17.3%	16.9%	19.9%
Sharpe Ratio	0.20	0.11	0.53	0.38

Source: Ken French Research Data, Greenline Partners analysis. High P/E is highest quintile P/E ratios. High Past Return is highest quintile 1 Month Price change. Low P/E is lowest quintile P/E ratios. Low Past Return is lowest quintile 1 Month Price change. Data from Jul 1963 to Dec 2015.

Most importantly, the conclusions from price reversal as a factor for equity selection are at odds with the results from momentum. Momentum assumes prices will continue moving in the direction they have been moving, while price reversal assumes they will reverse. Both factors show positive results. What may partially explain the contradiction is that we measure price change over different intervals for momentum and price reversal. For momentum, we use the average of trailing 2-to-12-month returns, while for price reversal, we used trailing 1-month (ST reversal) and trailing 60-month price change (LT reversal). This requires further study but at least points to the sensitivity of momentum to the period over which it is defined.

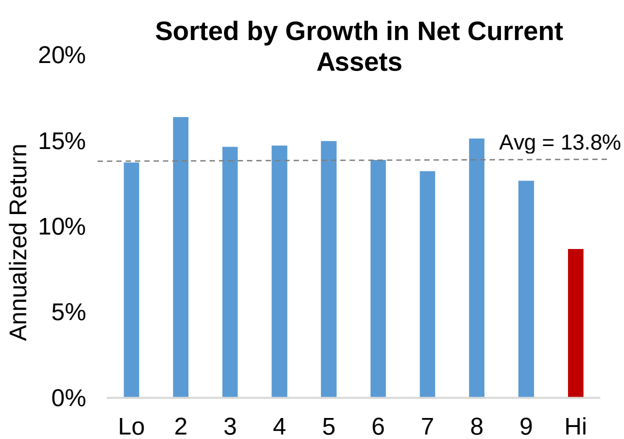
Volatility and Quality Factors are Mostly Priced In and Also Overlap with Value

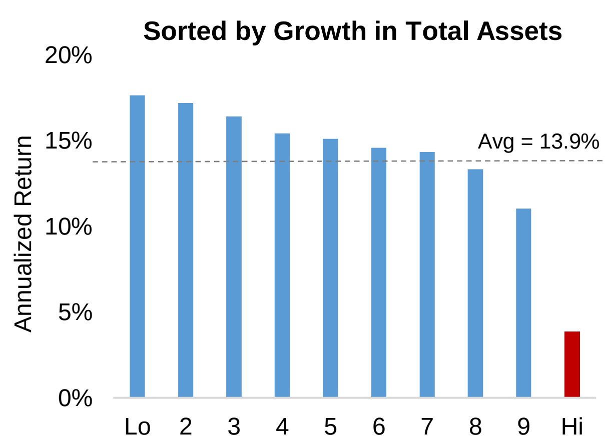
Quality and Volatility are the remaining macro groups of quantitative stock selection factors. Quality factors indicate business quality according to such metrics as profitability, asset growth rates and share issuance as indicators of need for financing. Volatility factors measure historical price volatility using different metrics such as volatility, beta, and excess volatility. We find that all of these factors are priced into markets except at their respective extremes and otherwise show little ability to separate high from low returning stocks. And as with the momentum factor, there is overlap with high valuation at the high volatility and low quality end of the spectrum.

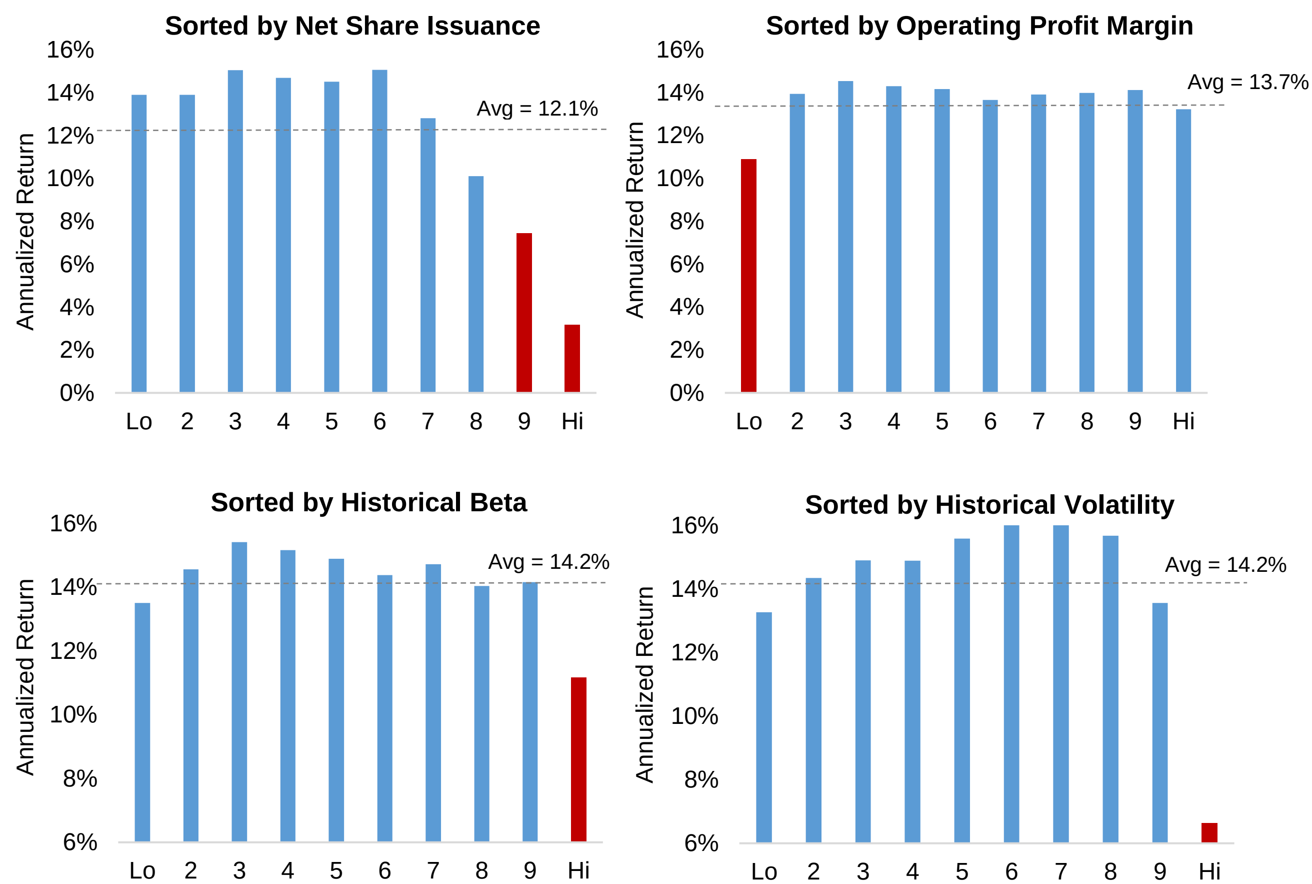
First, a short explanation of each factor and how they overlap with higher than average valuation ratios. Quality factors generally measure asset growth and profitability. Accruals, or net current asset growth, and Total Asset Growth (investment rate) are two such measures. Companies that are growing quickly will naturally experience more rapid growth in these asset measures. In many of these cases their valuation ratios will also be higher than average, reflecting their faster historical growth and therefore overlap with stocks with high valuation ratios. Net share issuance is self-explanatory and the connection to growth is that faster growing companies tend to be tapping external financing (share issuance) to take advantage of their available investment opportunities including cheap capital provided by eager investors. The connection between high valuation and low profitability companies is in their speculative nature. For example, a biotech company that does not have an approved drug will have no earnings (likely negative profitability) and a high valuation because the market is hopeful about its future prospects. On average this type of stock earns poor returns because it is of a speculative nature and never does turn into a profitable business. We therefore expect low quality companies as defined by these multiple metrics to behave like those with high valuations and also underperform the broad market.

Volatility factors typically measure historical price volatility or beta to the broad market. The highest growth businesses, which also tend to be smaller companies, also have the highest price volatility because of their lower business stability and sensitivity of investors to their continuing growth prospects. Naturally these fast growers also tend to be priced at high valuations. Because of these overlapping characteristics we again expect a similar return pattern from high volatility as we do high valuation groups of stocks. Sector differences also come into play with differences in volatility. Companies in stable sectors such as utilities should be less volatile than companies in the consumer electronics sector. We have written about these sector biases in previous papers so will not spend more time on this here.

The charts below show historical returns for all of these Quality and Volatility measures using data from 1963-2015. Again, we grouped the broad market into ten buckets and sorted from lowest to highest along each of these metrics. When we look across these charts, most show little difference in return across most of the quality and volatility buckets indicating that these factors are largely priced into the market. ***Consistent with our other studies above though, in each case, we do see that the extreme worst segments (low quality and high volatility) do underperform the averages.*** Total Asset Growth shows some consistency of improving returns as quality improves but as with the other metrics, the benefit is pronounced at the extreme by identifying the segment of the market to avoid. We highlight the deciles which show significantly lower returns than the broad market. In each case except for net share issuance, only the "worst" decile earned materially different and lower returns than the average. These are the segments that are most similar to the high valuation buckets from our first study.





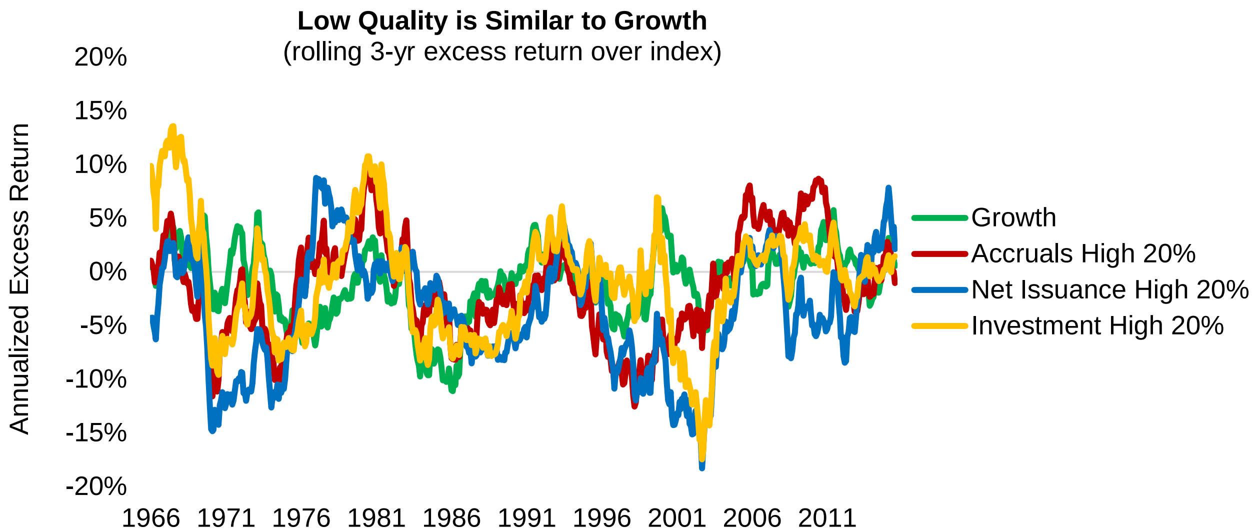


Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1963 – Dec 2015.

Note, we are only showing charts of returns and not Sharpe ratio as we did with the studies on value and momentum earlier in the paper. For quality measures, the study of Sharpe ratios led to identical conclusions as those drawn from the return studies. In this case we only show the return charts for brevity. With volatility measures we believe Sharpe ratio is a misleading measure of effectiveness. Proponents of low volatility investing claim it to be one of the most significant anomalies based on the improvement in Sharpe ratio, or volatility-adjusted return, as one moves from high to low volatility stocks. The Sharpe ratio is calculated as excess return over excess volatility. ***By definition, sorting the market by volatility will solve for an increasing denominator and therefore lower Sharpe ratio as one moves from left to right. This results in high Sharpe ratios for lower volatility equities, in spite of no return advantage. We believe ignores the true conceptual meaning of risk-adjusted return and that historical volatility is largely priced in.*** With this understanding, we are only showing returns and not Sharpe ratio for the volatility studies above. It should be noted that there is also an interest rate bias in low volatility strategies that has served as a tailwind over the last thirty years, which we have written about in a previous paper[7].

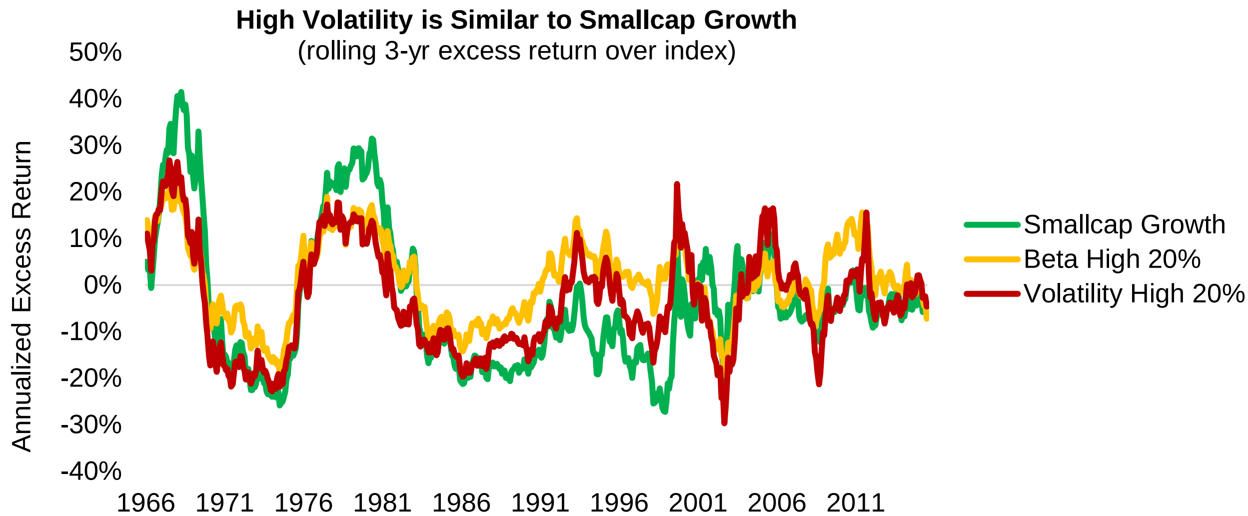
Just as we compared momentum to high valuation, below we compare the return streams of low quality and high volatility strategies to growth or high valuation stocks. The first chart below shows the excess returns of each quality metric over the broad market index for each of the lowest quality buckets compared to the highest 20% valuation bucket as measured by P/E (labeled Growth). We can see that all of these strategies outperform and underperform at similar times, illustrating their respective growth bias.

[7] "Low Volatility Investing Is Just a Bet on Falling Interest Rates", Greenline Partners, May 2016



Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1963-Dec 2015. Index is S&P 500.

And below we similarly compare the return pattern of each high volatility bucket compared to growth. Since we expect the highest volatility companies to be most like small cap growth, we specifically make this comparison. We see the same pattern of returns across these seemingly different quantitative metrics.

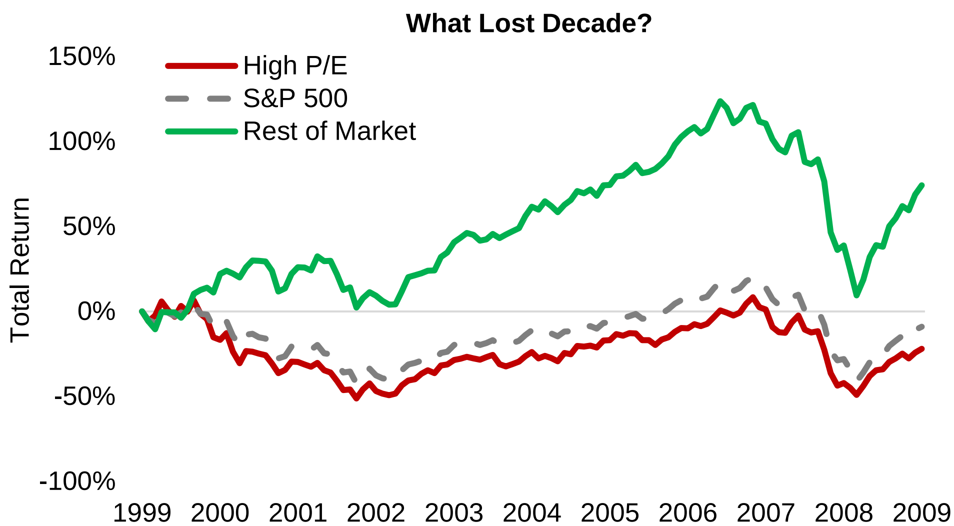


Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1963-Dec 2015. Index is S&P 500.

Smart beta and quantitative methods for security selection have grown in popularity since the collapse of the dot-com bubble. Some of this is likely due to increased data availability, as well as heavily marketed back-tests which show these strategies performing well through the bubble and subsequent bust. While the results have been superior both before and since the collapse of the dot-com bubble, ***even prior to this time, the data shows that most of the benefit of smart beta factors comes from using them as screens to avoid a small group of poor performers***. Appendix A contains the same charts as above, sorting the market by decile for each factor, for the period 1963-1995, prior to the dot-com bubble and crash. Appendix B also shows results for the same groups of factors across the major international markets of Europe, Japan and Asia ex-Japan. Here we again see the same dynamic that they are generally best used as screening tools.

Avoid the Losers to Avoid Lost Decades

We have shown that most of the popular smart beta metrics are more effective at avoiding potential losers than they are at selecting the best performers. As just one example of the power of avoiding the losers, we look at the so called "lost decade" for global equities from 2000-2009. During this period, the S&P 500 had a negative cumulative return after suffering two drawdowns of over 50% following the dot-com crash and then the subprime mortgage crisis. But we can see that simply avoiding the highest valued stocks would have delivered a great return in spite of these major market swings. The chart below shows the cumulative return of the highest 20% P/E stocks in our universe compared to the performance of the remainder of the index. ***There was no "lost decade" for the remainder of the market.*** Note also how similar the return of the S&P 500 was to the highest valuation stocks – market cap weighted indices have a bias to growth, which underperforms over time.



Source: Ken French Data Library, Greenline Partners analysis. Data from Jan 2000-Dec 2009.

The same relative performance occurred across global equity markets as they collectively endured major price swings over this decade. The table below summarizes the returns for the highest valuation quintile compared to the rest of the market across the major economies. Only for Japan, with their sustained deflation, was the first decade of the 2000's truly a lost decade.

2000-2009	US		Europe		Japan		Asia ex-Jpn	
	High Priced	Rest of Market	High Priced	Rest of Market	High Priced	Rest of Market	High Priced	Rest of Market
Annual Return	-2.4%	5.7%	2.2%	4.8%	-8.1%	0.9%	5.8%	11.1%
Volatility	18.9%	15.9%	22.8%	20.7%	22.9%	18.3%	24.0%	21.2%
Ratio	-0.13	0.36	0.10	0.23	-0.35	0.05	0.24	0.52

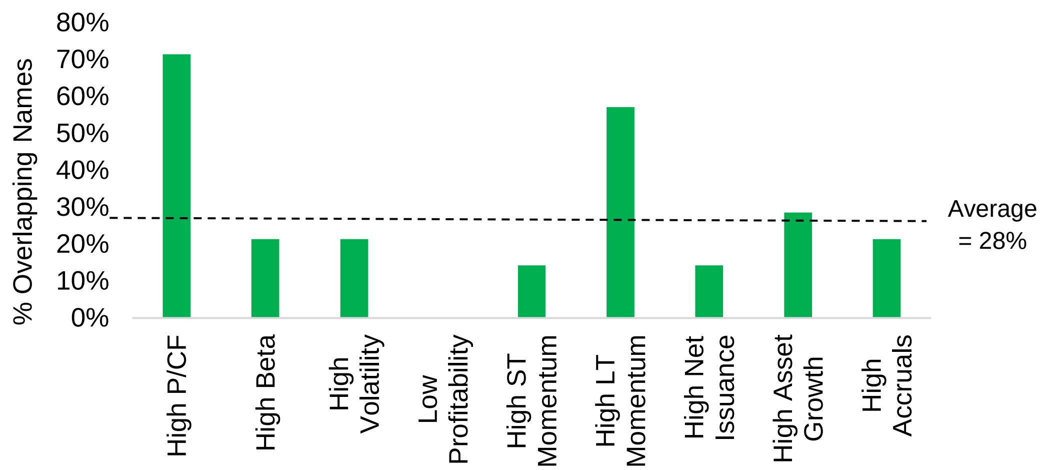
Source: Ken French Data Library, Greenline Partners analysis. Data from Jan 2000-Dec 2009. High Priced in the US is the highest quintile ranked by P/E. High Priced in Europe, Japan and Asia ex-Jpn is the highest quintile ranked by P/B.

Combine Multiple Factors to More Consistently Avoid the Worst Performers and Improve Returns

We have shown how different quantitative factors overlap with each other such as the similarity in performance of high valuation and high volatility segments of the market. We would expect there to be overlap between the actual stocks screened out by these metrics. If there is wide overlap of individual stocks, then we can use just a single metric to screen out poor performers without degradation of results. If there is low overlap across different screening metrics, then using multiple metrics should improve returns and lower volatility.

To see the potential overlap between the various screening metrics, we analyzed the universe of the largest 3000 stocks in the US by market capitalization. For each metric across the Value, Quality, Momentum and Volatility categories, we sorted the universe and screened out the "worst" ranking 20% in each category. The chart below graphically shows the amount of overlap with the initial P/E screen. Naturally there is the highest overlap between the valuation metrics of P/CF and P/E, aside from this there is low overlap across each metric with the average number of overlapping names at only 28%. This suggests that using all of the screens simultaneously should result in an improved portfolio over using only a single screen by more consistently being able to screen out the poor performers.

Screens Show Low Overlap With Each Other



Percent overlap is the number of overlapping stocks with the High 20% P/E screen. Source: Bloomberg Equity Backtester, Greenline Partners analysis. Data as of 5/31/2016

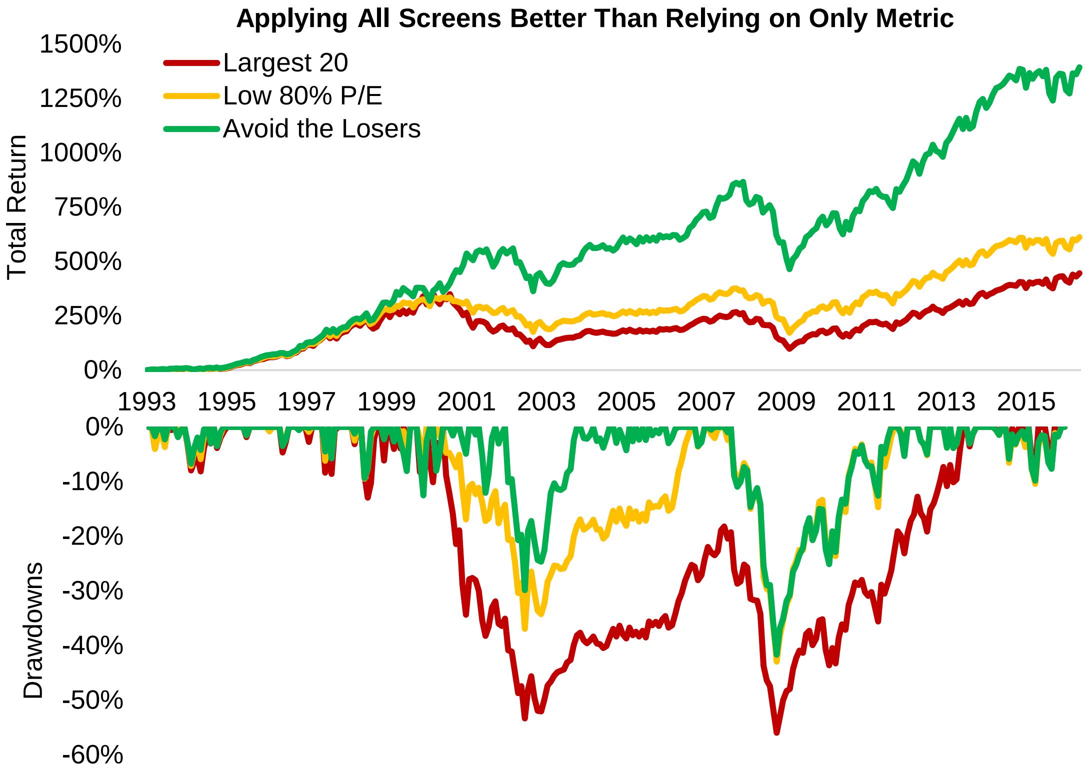
We compare three portfolios of 20 stocks to show the portfolio improvements from using multiple factors versus only one. We start with a benchmark of only the largest 20 US stocks. We purposely use only 20 stocks for a few reasons, first because this number of mega cap companies represents an adequately diversified portfolio, as one can see by the volatility statistics below compared to the S&P 500. Second, focusing on only a small segment of the universe minimizes any unintended biases like that to small cap stocks. And finally, mega caps should be the most efficient part of the equity universe and therefore a good test of whether such quantitative metrics can work.

The chart below compares the results for three simulations from Feb 1993 to Jun 2016:

a) The benchmark: Largest 20 US equities, market cap weighted
b) Eliminate highest 20% by P/E and then select the largest 20 from the remaining, equal weighted
c) Eliminate based on a broad array of quantitative metrics studied in this paper[8] and select the largest 20 that pass all screens, equal weighted. We call this approach "avoid the losers".

[8] For the ETW, or eliminate the worst study, we screened out the following: high 20% P/E, high 20% P/CF, high 10% trailing 1-yr volatility, high 10% 30-day price change, low 10% operating profitability, high 20% net share issuance, high 10% total asset growth. These values were all informed by our study. Metrics not used such as 5-yr price change were determined to be priced in.

We can see from the chart that using multiple metrics improved performance significantly over just one.



Source: Bloomberg Equity Backtester. Data from Feb 1993-Jun 2016.

Many strategies outperformed equity indices following the dot-com collapse by limiting or avoiding exposure to the technology sector. We wanted to make sure the "avoid the losers" approach was not driven solely by success in this one-time period hence we also show summary statistics excluding this period from 1998-2002. Here again, the "avoid the losers" approach outperformed using only P/E ratios for screening on both an absolute return and risk-adjusted basis. The table below summarizes this performance.

Full History	**Largest 20[9]**	**Low 80% P/E**	**Avoid the Losers**
Annual Return	7.5%	8.8%	12.3%
Volatility	15.1%	13.6%	14.4%
Sharpe Ratio	0.33	0.46	0.68
Excluding 1998-2002	**Largest 20**	**Low 80% P/E**	**Avoid the Losers**
Annual Return	10.8%	10.9%	12.4%
Volatility	12.9%	12.7%	12.6%
Sharpe Ratio	0.67	0.69	0.81

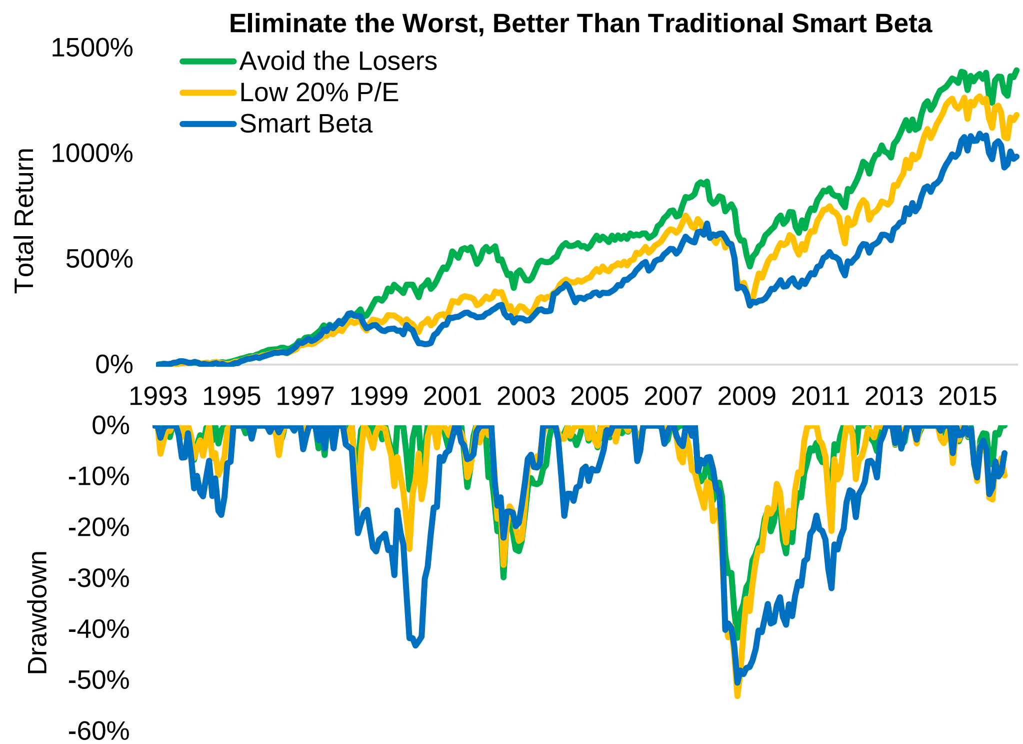
Source: Bloomberg.

We always remain skeptical of back-tests and encourage readers to do the same. Many back-tests only work when applied over short time periods such as a 3-year look back or only with monthly rebalancing. We studied the "avoid the losers" approach using long term look backs and different rebalancing periods and all tests showed outperformance and therefore a robust result. In these tests, all of the portfolios shown had low turnover so relative performance is more likely to be repeatable in the real world. Screening based

[9] For comparison, the S&P 500 return over this time was 9.0% with 14.6% volatility. Very similar to our 20 stock benchmark.

on low P/E only had historical turnover of 14% while using all quantitative metrics combined resulted in turnover of 28% when portfolios were reconstituted annually. These values are low enough to be efficient for high tax paying investors.

For comparison, we show how this "avoid the losers" approach would have performed versus traditional low valuation and "smart" beta approaches. For our value portfolio, we screen for the lowest 20% P/E and then market cap weight the resulting portfolio, similar to a value index. For our "smart" beta portfolio, we screen based on the following metrics: low 33% of P/E, high 33% operating profitability, high 33% 1-yr price change, and low 33% trailing 12m volatility to incorporate metrics from each of the four macro risk factor buckets of valuation, quality, momentum and volatility. The stocks in the resulting portfolio must pass all screens. The chart below compares the results to the original "avoid the losers" approach which outperforms over the full time period, both including and excluding the dot-com bubble/bust years.



Source: Bloomberg Equity Backtester. Data from Feb 1993-Jun 2016.

The table below summarizes performance over the whole period and excluding the dot-com bubble period for all of the screening approaches back-tested above.

Full History	**Low 20% P/E**	**"Smart" Beta**	**Avoid the Losers**
Annual Return	11.3%	10.9%	12.3%
Volatility	17.0%	17.4%	14.4%
Sharpe Ratio	0.52	0.48	0.68
Excluding 1998-2002	**Low 20% P/E**	**"Smart" Beta**	**Avoid the Losers**
Annual Return	12.6%	13.9%	12.4%
Volatility	15.7%	16.2%	12.6%
Sharpe Ratio	0.66	0.72	0.81

Smart Beta is a market cap weighted portfolio that passes the following screens: low 33% of P/E, high 33% operating profitability, high 33% 1-yr price change, and low 33% trailing 12m volatility. Source: Bloomberg. Note, S&P 500 returns over this period was 9.1% for the full period and 11.8% excluding 1998-2002.

Conclusion

Finding opportunities for outperformance is rare as today's investing world is dominated by the actions of professional, informed investors. As a result, most so-called market anomalies should not exist in such a competitive and "efficient enough" market. These are the characteristics of a Loser's Game and require a different strategy than should be utilized playing a Winner's Game. Our research confirms that as in other Loser's Games, avoiding mistakes is more powerful than searching for winners and quantitative factors are best utilized for this purpose.

Our study of various quantitative factors shows that markets price in these "smart" beta factors and that the only anomaly that consistently appears within is the ability of these quantitative metrics to screen out only the most speculative companies with low prospective returns. We looked at factors across Value, Momentum, Quality, and Volatility groupings and all showed a similar ability to screen out a small segment of the market (typically 10-20%) that has the highest likelihood of low future returns. Momentum was an exception to this but it is sensitive to the definition applied and should only become more difficult to implement successfully as more investors chase this intuitively simple strategy.

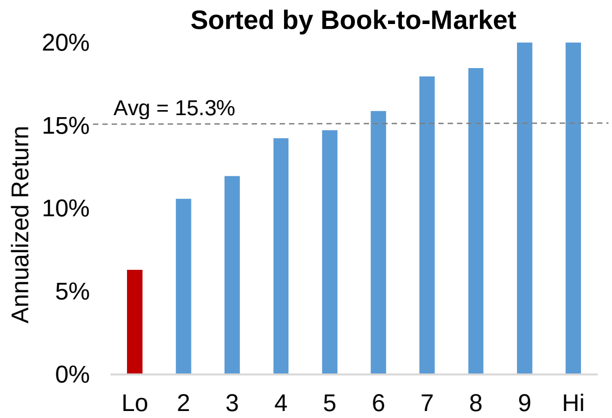
We think the "worst" segments along each factor are driven by the psychological bias of investors to chase lottery ticket outcomes, large hoped for upside that generally does not materialize. Therefore it was not surprising to see the return streams of the "worst" segment from each metric correlated to each other. In spite of this, combining multiple quantitative metrics improved the robustness of the equity selection process to avoid potential losers versus relying on only a single valuation measure like P/E ratio.

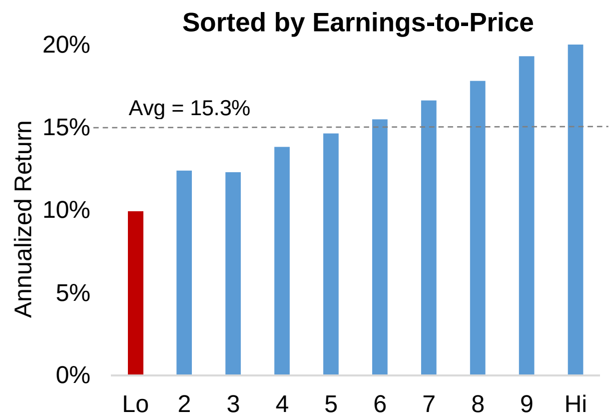
The large sum of assets attracted by "smart" beta strategies is evidence of their popularity; however our research shows that most strategies relying on these metrics for outperformance will only generate tracking error over time. In a market that has been made highly efficient by the sheer number and size of informed players chasing high profits, we think a more appropriate strategy for winning is to avoid mistakes resulting from selecting the most obviously overvalued, speculative stocks.

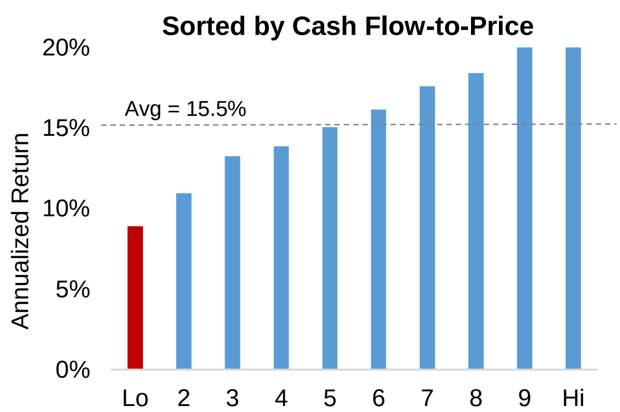
* * * * *

Appendix A: Risk Factor Performance Prior to Dot-Com Boom and Crash, 1963-1995

Value Metrics

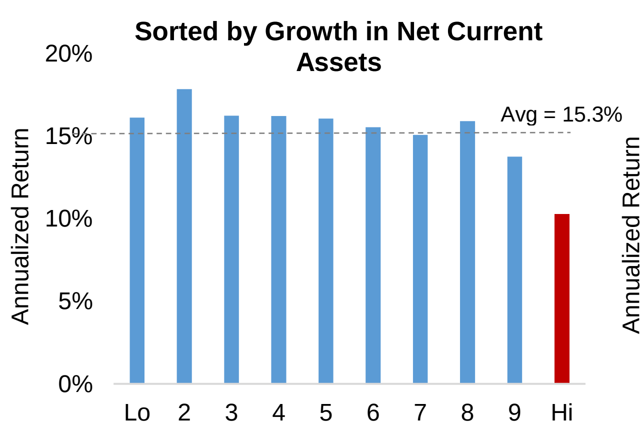


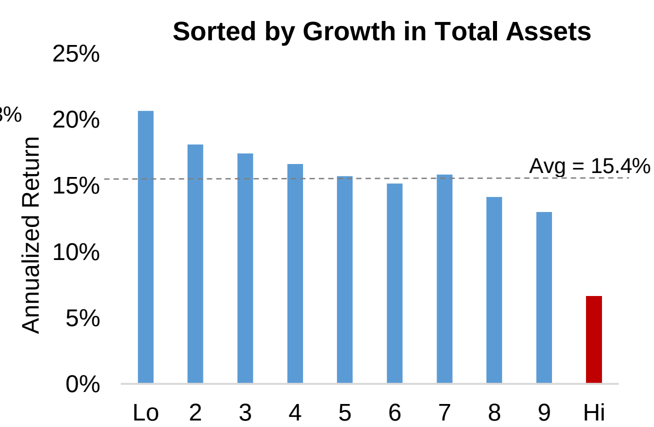


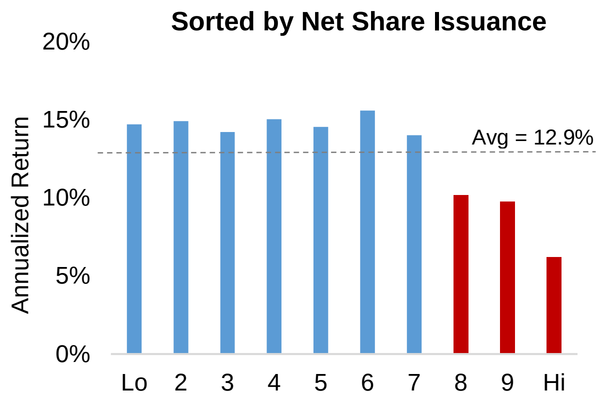


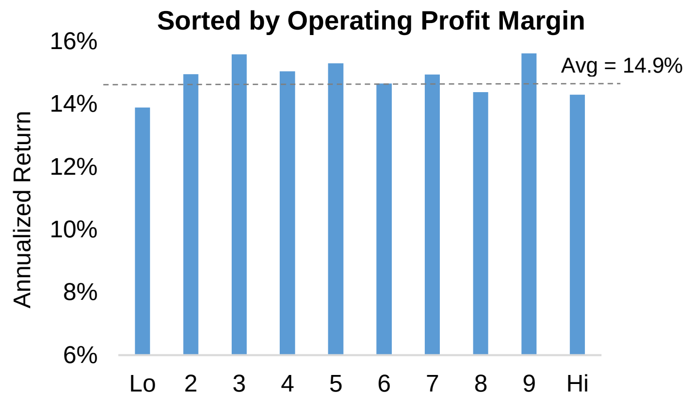
Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1963-Dec 2015.

Quality Metrics



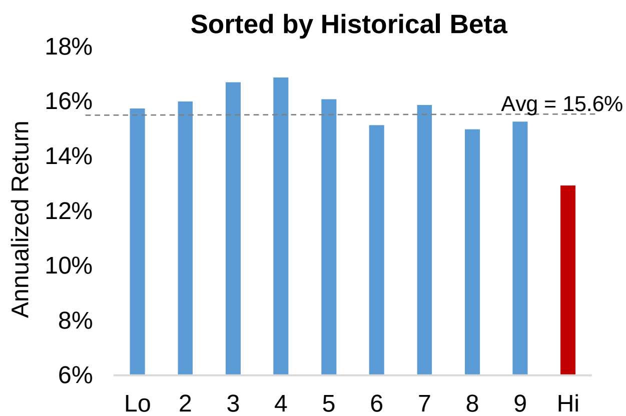


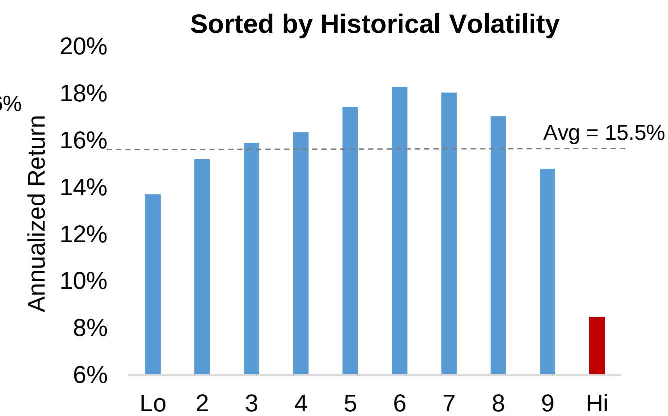


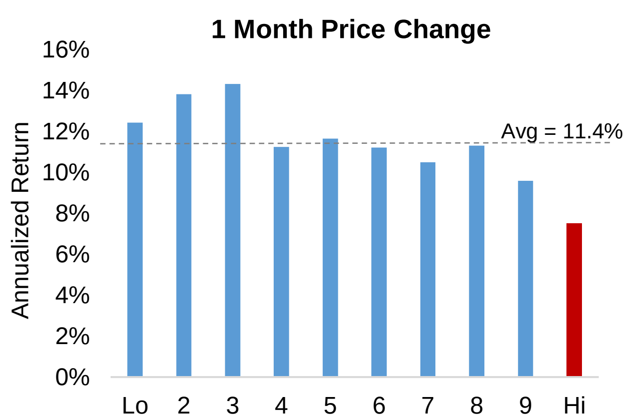


Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1963-Dec 2015.

Historical Price Volatility and Momentum Metrics



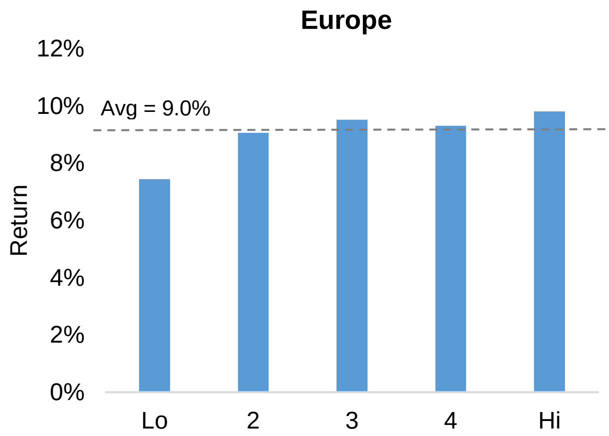


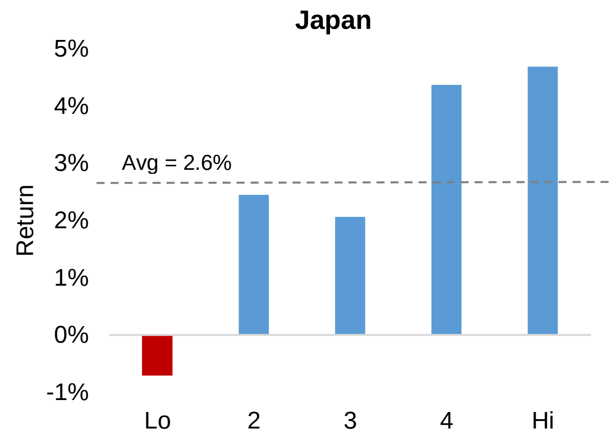


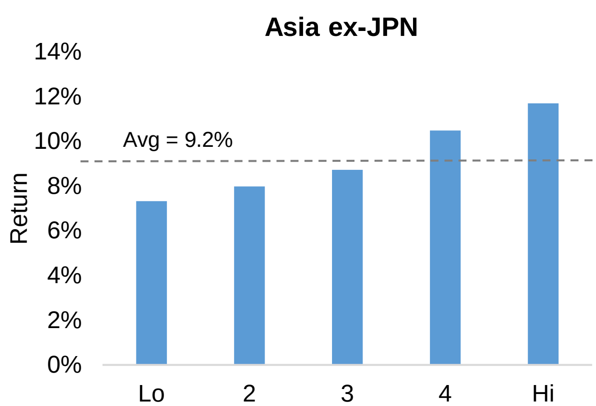
Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1963-Dec 2015.

Appendix B: Risk Factors for International Markets, 1990-2016

Sorted by Book-to-Market

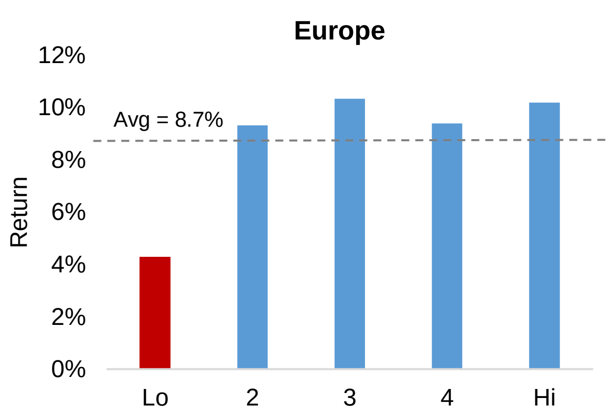


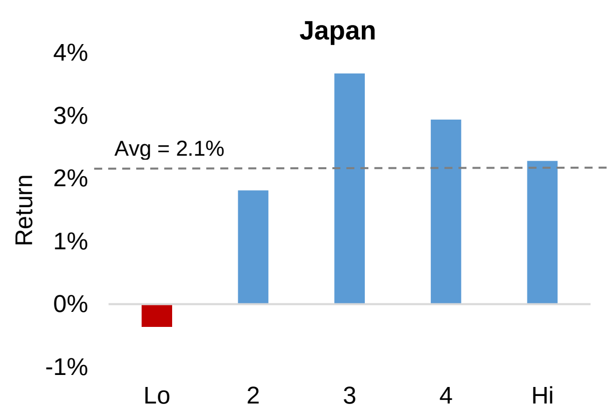


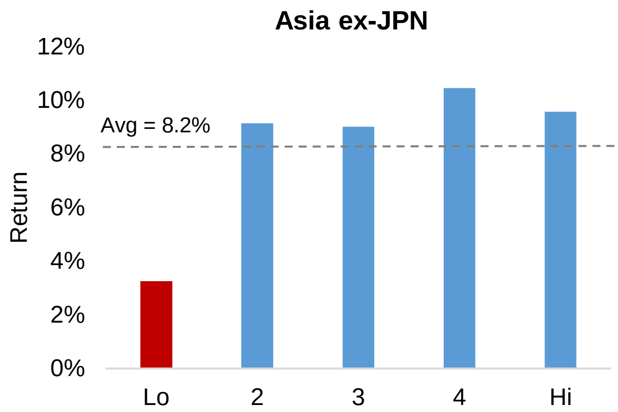


Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1990-Apr 2016.

Sorted by Operating Profitability

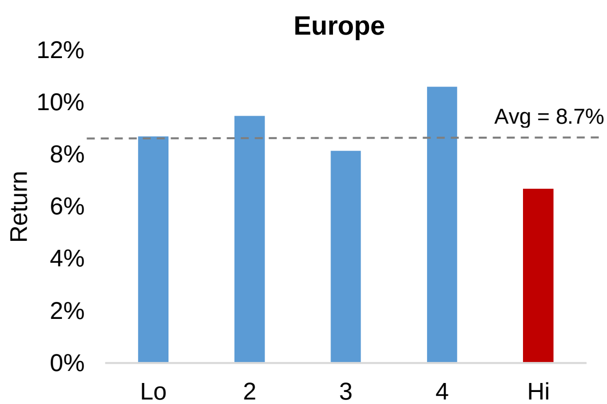


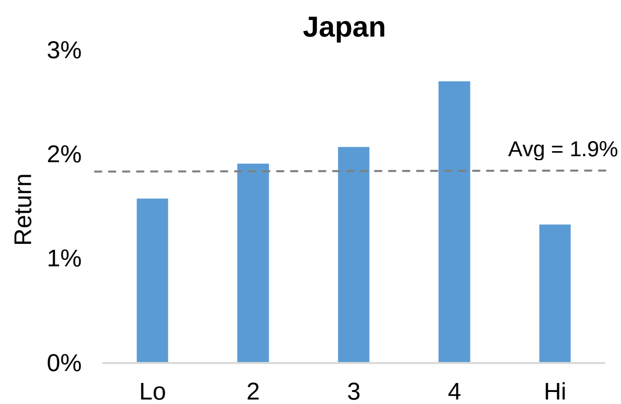


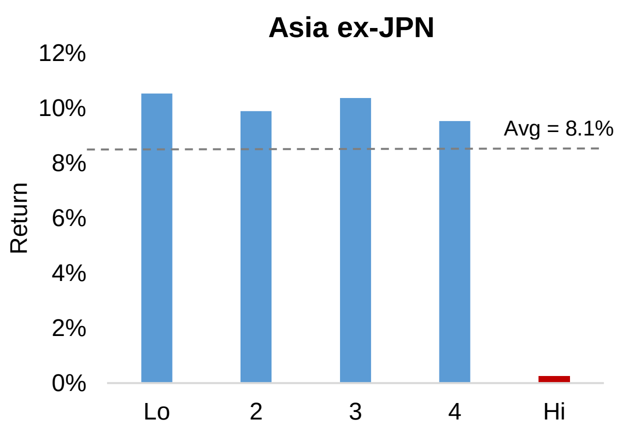


Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1990-Apr 2016.

Sorted by Investment Level (Growth in Total Assets)

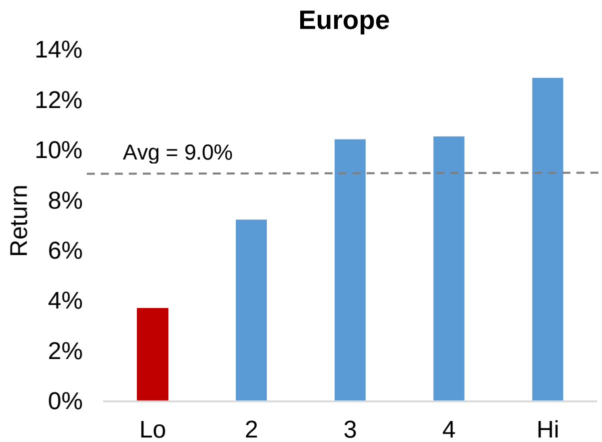


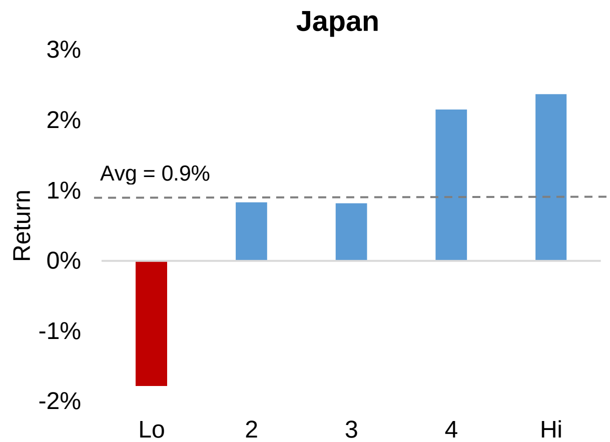


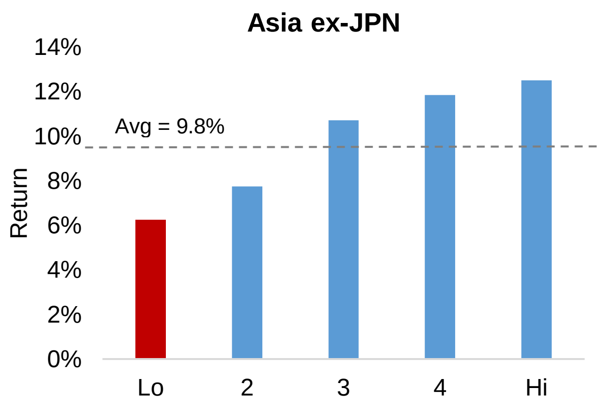


Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1990-Apr 2016.

Sorted by Historical Price Momentum







Source: Ken French Data Library, Greenline Partners analysis. Data from Jul 1990-Apr 2016.

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