# IQ INSIGHTS

## Equal Weighting and Other Forms of Size Tilting

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### Introduction

Alongside the value premium, the size factor can be a source of return that investors have long sought to capture in their portfolios. This premium is based on the belief that smaller stocks, as measured by market capitalization, tend to outperform larger stocks over the long term. Beyond just investing in smaller companies, the factor can also be captured within a large cap universe — the S&P 500 Index or the FTSE 100 Index, for example — by equally weighting constituents rather than using market capitalization weights. Such an equal weighted strategy is probably the most straightforward way to capture the size factor.

There are other options to equal weighting. State Street Global Advisors (SSGA) has developed a tilting methodology, and diversity weighting can also be used to access the size premium. These approaches provide different starting points for looking at the risks and return attributable to the effect.

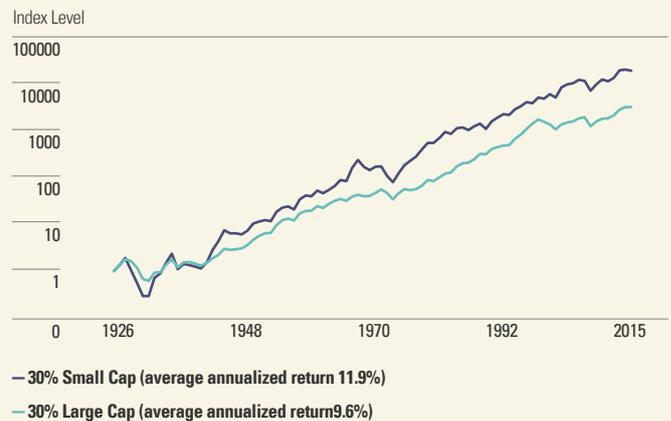In this article, we seek to address three broad questions:

- Is there compelling evidence for a size premium and if so, why does it exist?

- How might the size factor be implemented in a portfolio, and what challenges could investors face?

- Does a size tilted portfolio have additional exposures or diversification benefits to consider?

### Evidence for the Size Premium: History and Summary

Research by Banz (1981) and Reinganum (1981) first highlighted that small capitalization stocks tend to outperform large capitalization stocks on a risk adjusted basis. Fama and French (1992, 1993) have shown that size, along with value and market beta, explains a significant part of the cross sectional variation in stock returns. The phenomenon was confirmed in both developed and emerging markets by Rizova (2006). And size does not appear to be a short-term anomaly; according to Fama and French, the smallest 30% of companies have outperformed the largest 30% of companies by 2.3 percentage points per annum over 90 years in the United States (see Figure 1). However, this comes with significantly higher volatility.

### Figure 1: Long-Term Size Premium in the US

|  | 30% Small Cap | 30% Large Cap |
|---|---|---|
| Return (%) | 11.9 | 9.6 |
| Volatility (%) | 33.8 | 19.5 |
| Sharpe ratio | 0.35 | 0.49 |



— 30% Small Cap (average annualized return 11.9%)
— 30% Large Cap (average annualized return 9.6%)

Source: Fama and French, 1926–2016.
Past performance is no guarantee of future results.

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## Figure 2: International Size Premium

Equal Weight Excess Return (%pts)
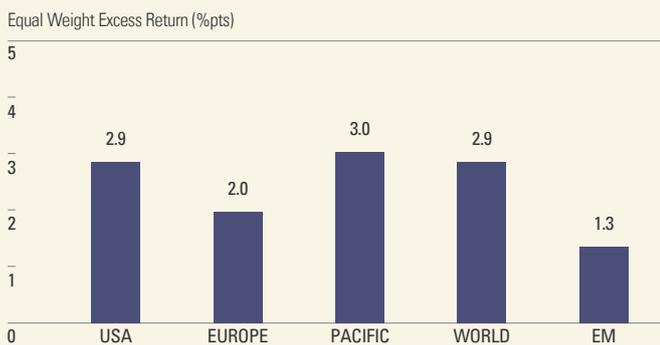


Source: MSCI, 1998–2016.

Past performance is no guarantee of future results. The indices used are as follows: MSCI USA Index, MSCI Europe Index, MSCI Pacific Index, MSCI World Index, MSCI Emerging Markets Index (EM).

Another way to view evidence of the size premium is to start from an equal weighted position, with each stock having the same initial weight in the portfolio. This has the effect of underweighting large cap stocks and overweighting small cap stocks relative to a market cap weighted benchmark. Using the MSCI equal weighted indices across other regions appears to show a size premium that is broadly similar in magnitude to that shown above in the US — although over a much shorter time period (see Figure 2).

That the empirical evidence of a size premium appears to be strong over long time periods and across different geographies raises the question, why might this be the case? The possible explanations can broadly be divided into two camps: either risk based or systematic investor errors and mistakes.

Risk-based theories assume that small companies are earning a return premium as a result of one or more systematic risk factors which cannot be diversified away. Suggestions put forward for these factors include lower liquidity [Amihud (2002)], information uncertainty [Zhang (2006)], financial distress [Chan and Chen (1991)], default risk [Vassalou and Xing (2004)] and generally greater sensitivity to macroeconomic factors.[1]

With regard to investors making systematic errors or mistakes, many of the reasons put forward are based on concepts from behavioral finance, including chasing winners, over-reaction, overconfidence and loss aversion. There may also be links to the use of indices for benchmarking and the short-term nature of performance monitoring, which is likely to lead investors to focus on larger cap names and to allow less time for their active decisions to pay off.

Furthermore, it is fair to say that investors have a demand for liquidity in their portfolios and so they are likely to favor large cap securities. Smaller cap companies generally have lower liquidity and are thus more expensive to trade, suggesting some form of liquidity risk premium should be earned by investors who hold small cap stocks. Spreads, commissions and market impacts also tend to be higher for smaller caps. Purchasing the MSCI World Equal Weight Index costs 17 basis points (bps), versus 10 bps for the market cap weight MSCI World Index (see Figure 3).

## Figure 3: Large Cap vs Small Cap Cost Analysis

Basis Points



■ MSCI World Equal Weight Index  ■ MSCI World Index (market cap)
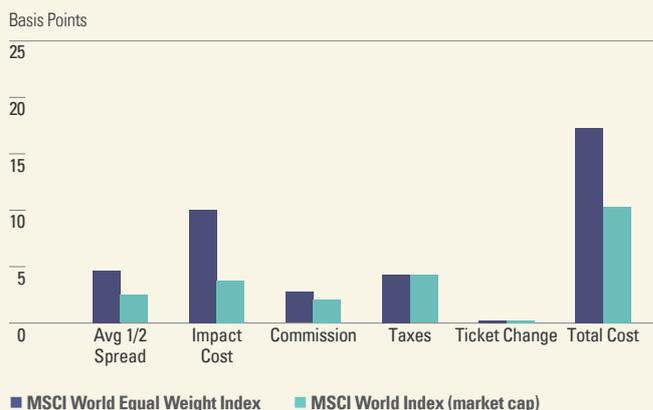
Source: SSGA, Transaction cost analysis as of 4 October 2016.

### Capturing the Size Effect

Investors can take advantage of the size factor in a number of different ways. The most common and straightforward approach involves splitting the universe into several buckets by market capitalization, such as large, mid and small cap, and then allocating more weight to the mid and small cap buckets relative to their market cap weights.

For example, MSCI targets a breakdown within its indices of 70% for large cap, 15% for mid cap and 15% for small cap, while FTSE targets 70% for large cap, 20% for mid cap and 10% for small cap. Combining the large and mid cap sub-universes is typically the "standard" market cap weight index, while including large, mid and small cap is the full opportunity set for that index (see Figure 4).

### Figure 4: MSCI Market Capitalization Breakdown

|  | Minimum Cap |
| --- | --- |
| World Large Cap | 1922 |
| World Mid Cap | 774 |
| World Small Cap | 14 |

Source: MSCI World Index universe in USD millions, 2016.

**Size Tilting** is another option that we can consider for implementing the size factor in a portfolio. The SSGA Size Tilted approach uses a 20 sub-portfolio framework and a proprietary tilting methodology to allocate more assets to smaller companies and fewer assets to larger companies compared to a standard market cap index. The portfolio is rebalanced on an annual basis.

We can calculate the annualized return for each sub-portfolio of the MSCI World universe over the period 1989–2016, with the smallest companies in sub-portfolios 1–5 to the left and the largest companies in sub-portfolios 16–20 to the right (see Figure 5). This analysis provides further evidence of a size premium. It is also interesting that these sub-portfolios can generate higher returns with generally lower volatility.
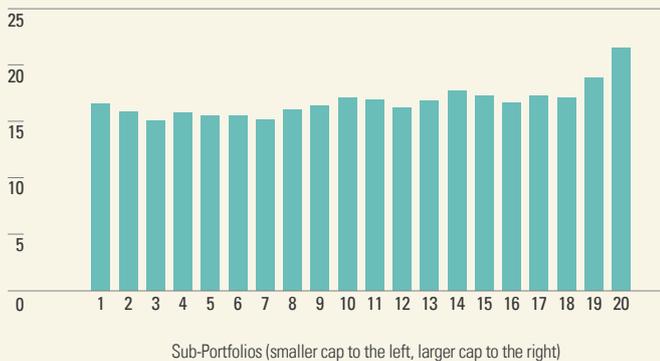
**Figure 5: SSGA Size Tilted* vs MSCI World****

| | SSGA Size Tilted | MSCI World | Difference |
|---|---|---|---|
| Return (%) | 8.0 | 6.9 | 1.1 |
| Volatility (%) | 15.2 | 15.1 | 1.1 |
| Sharpe ratio | 0.52 | 0.46 | — |

Size Sorted Returns for the SSGA Size Tilted Portfolio (%)



Sub-Portfolios (smaller cap to the left, larger cap to the right)
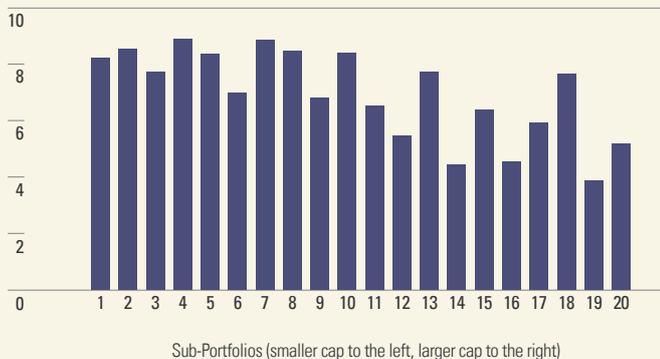
Size Sorted Volatility for the SSGA Size Tilted Portfolio (%)



Sub-Portfolios (smaller cap to the left, larger cap to the right)

Source: SSGA, MSCI World universe in USD, 1989–2016. *Backtest performance is not indicative of the past or future performance of any SSGA offering. The portion of results through 30 June 2016 represents a backtest of the SSGA Size Tilted model, which means those results were achieved through the retroactive application of a model that was developed with the benefit of hindsight. All data shown above do not represent the results of actual trading and, in fact, actual results could differ substantially, and there is the potential for loss as well as profit. The performance does not reflect management fees, transaction costs and other fees and expenses a client would have to pay, which reduce returns. Please refer to the Backtesting Methodology for a description of the methodology used as well as an important discussion of the inherent limitations of backtested results. **Past performance is not a guarantee of future results. The index returns reflect all items of income, gain and loss and the reinvestment of dividends and other income.

**Equal Weighting** is the third approach for capturing the size premium, a simple portfolio construction technique that gives equal weight to each stock in the universe. In the S&P 500 Equal Weight Index, for example, each stock has a weight of 1/500=0.2%. As individual stock prices move after each rebalancing, stock weights drift away from their initial equal weights, and the index is no longer equally weighted. It is thus necessary to rebalance on a regular basis, with quarterly accepted as a reasonable frequency for MSCI and S&P indices.

It seems *a priori* that the equally weighted approach adds value by its buy low/sell high effect — that is, selling outperformers and buying underperformers — at each rebalance.

This rebalancing effect has been analyzed by Bernstein and Wilkinson (1997) through the following formula:

$$\text{Rebalancing Effect} = \tfrac{1}{2}[\textstyle\sum w_i v_{ii} - \sum w_i w_j v_{ij}] + [\textstyle\sum w_i (1+r_i) - (\sum w_i (1+r_i)^N)^{1/N}]$$

where $w_i$ are portfolio weights, $v_{ii}$ are the covariance matrix of stock returns, $r_i$ are average stock returns.

The first term is the contrarian effect. It represents the short-term reversal and is always positive.

The second term is the dispersion effect. It represents the long-term trend and is always negative.

If the contrarian effect (short-term reversal) is larger than the dispersion effect (long-term trend), then the rebalancing effect of the equal weight strategy is positive.

Notably, this effect is not systematically positive but rather depends on the universe, the period and the rebalancing frequency. However, this effect has been positive for the S&P 500 Equal Weight Index (see Figure 6).

**Figure 6: S&P 500 Equal Weight Rebalancing Effect**

| | Monthly (%) | Quarterly (%) | Yearly (%) | Buy Hold (%) |
|---|---|---|---|---|
| Return | 5.8 | 5.9 | 5.9 | 4.7 |
| Volatility | 22.1 | 21.9 | 21.3 | 21.1 |
| Contrarian Effect | 5.7 | 5.7 | 5.4 | — |
| Dispersion Effect | -4.5 | -4.4 | -4.2 | — |
| Rebalancing Effect | 1.2 | 1.3 | 1.2 | — |

Source: Standard & Poor's, Ossiam, 1999–2013.
Past performance is not a guarantee of future results. The index returns are unmanaged and do not reflect the deduction of any fees or expenses. The index returns reflect all items of income, gain and loss and the reinvestment of dividends and other income

It is interesting to compare the S&P 500 Equal Weight Index to the standard S&P 500 market cap index and the S&P 100 Index, which comprises the 100 largest market capitalization stocks of the S&P 500 and thus can be considered a large cap index. Based on this performance, volatility and Sharpe ratio comparison, the S&P 500 Equal Weight outperforms the S&P 500, and the S&P 500 outperforms the S&P 100. Both S&P 500 definitions have higher Sharpe ratios than the large cap S&P 100 index (see Figure 7).

**Figure 7: S&P Equal Weight Performance**

| | S&P 500 Equal Weight | S&P 100 | S&P 500 |
|---|---|---|---|
| Return (%) | 11.4 | 9.5 | 9.7 |
| Volatility (%) | 16.2 | 14.7 | 14.5 |
| Sharpe Ratio | 0.70 | 0.65 | 0.67 |

Source: Standard & Poor's in USD, 1990–2016.
Past performance is not a guarantee of future results. The index returns are unmanaged and do not reflect the deduction of any fees or expenses. The index returns reflect all items of income, gain and loss and the reinvestment of dividends and other income.

Similar analysis can also be carried out using the MSCI World Equal Weight Index versus the standard cap weighted MSCI World Index, which is made up of two size segments, Large Cap and Mid Cap. Not only has the equal weight index outperformed the standard index and the large cap segment over time, it even gives a better outcome than the mid cap segment. (see Figure 8).

### Figure 8: MSCI World Equal Weight Performance

|  | Equal Weight | Large Cap | Mid Cap | World |
|---|---|---|---|---|
| Return (%) | 7.6 | 4.2 | 7.3 | 4.7 |
| Volatility (%) | 16.7 | 15.4 | 17.0 | 15.5 |
| Sharpe Ratio | 0.45 | 0.27 | 0.43 | 0.30 |



- Equal Weight (7.6% per year)
- Large Cap (4.2% per year)
- Mid Cap (7.3% per year)
- World (4.7% per year)

Source: MSCI in USD, 1998–2016.

Past performance is not a guarantee of future results. The index returns reflect all items of income, gain and loss and the reinvestment of dividends and other income.

In terms of MSCI World sectors, the sector weight is proportional to the number of stocks in that sector. So the MSCI World Equal Weight Index is overweight sectors like Industrials and Materials — which have more small and mid cap names — and underweight Health Care and Information Technology — sectors that tend to have a higher concentration of large companies (see Figure 9).

In terms of MSCI World country weights, the main difference between equal weight and market cap weight is an overweight of Japan — due to the fragmentation of the Japanese stock market — and the underweight of the United States — due to the US market's concentration in mega cap stocks (see Figure 10).

While an equal weighted portfolio will be less concentrated than a cap weighted portfolio, this comes at a price — namely, lower liquidity and higher transactions costs, which can be important given the requirement to regularly rebalance back to equal weight positions.

**Diversity Weighting** has been proposed by Fernholz et al (1998) as another option for index construction intended to address these concerns. With diversity weighting, a maximum stock weight is set and any weight above this is redistributed equally among the remaining constituents. This can perhaps be seen as a hybrid between equal weight and cap weight: the higher the maximum weight ceiling, the closer the diversity weight index will be to the market cap index, while the lower the ceiling, the closer it will be to equal weight.

### Figure 9: MSCI World Equal Weight by Sector

| Sector (% of Total) | Equal Weight | World | Difference |
|---|---|---|---|
| Consumer Discretionary | 15.4 | 12.5 | 2.9 |
| Consumer Staples | 7.4 | 10.7 | -3.3 |
| Energy | 5.4 | 6.6 | -1.2 |
| Financials | 15.1 | 16.3 | -1.2 |
| Health Care | 8.0 | 13.0 | -4.9 |
| Industrials | 15.8 | 11.0 | 4.8 |
| Information Technology | 10.1 | 14.8 | -4.7 |
| Materials | 8.6 | 4.9 | 3.8 |
| Real Estate | 6.6 | 3.5 | 3.2 |
| Telecommunication Services | 2.6 | 3.5 | -0.9 |
| Utilities | 4.9 | 3.3 | 1.6 |

Source: MSCI, 2016.

### Figure 10: Top 10 MSCI World Equal Weight by Country

| Country (% of Total) | Equal Weight | World | Difference |
|---|---|---|---|
| United States | 38.4 | 59.6 | -21.2 |
| Japan | 19.9 | 8.8 | 11.2 |
| United Kingdom | 6.4 | 7.0 | -0.7 |
| Canada | 5.8 | 3.5 | 2.3 |
| Australia | 4.6 | 2.7 | 2.0 |
| France | 4.4 | 3.6 | 0.8 |
| Germany | 3.3 | 3.3 | 0.0 |
| Hong Kong | 2.8 | 1.3 | 1.6 |
| Switzerland | 2.1 | 3.3 | -1.2 |
| Sweden | 1.7 | 1.0 | 0.7 |

Source: MSCI, 2016.

Countries are as of the date indicated, are subject to change, and should not be relied upon as current thereafter.

### Equal Weighted Approach: Beyond the Size Factor

While adopting an equal weighted approach provides the investor with the desired exposure to the size factor, a by-product can be exposures to other factors, including diversification and value.

Regarding diversification exposure, we can consider a hypothetical hierarchy of investor expectations that leads to the optimality of equal weighting under certain conditions, as follows:

- If all expected returns are equal, a minimum volatility approach gives the optimal portfolio.[2]

- If there is no view on correlations, a volatility weighted approach gives the optimal portfolio.

- If there is only a view on correlation, a maximum decorrelation approach gives the optimal portfolio.[3]

- If there is no view at all, however, the equal weight portfolio is optimal.

The equal weight portfolio can also be seen as minimum relative risk in the sense that if any of its holdings went bankrupt, the portfolio would face the minimum loss. This can be captured by the inverse of the Herfindhal index, which gives the equivalent number of stocks. The equal weight portfolio appears to have the maximum possible equivalent number of stocks, whereas the market cap portfolio is more concentrated than its official number of stocks suggests (see Figure 11).

**Figure 11: Equivalent Number of Stocks**

|  | World | Equal Weight |
|---|---|---|
| Official Number of Stocks | 1641 | 1641 |
| Equivalent Number of Stocks | 362 | 1641 |

Source: SSGA, MSCI, 2016.

Regarding value exposure, the equal weight portfolio has some positive value exposure in the sense that the weights drift away from equal as the market moves, and thus have to be readjusted back to equal weights on a regular basis. When the portfolio is readjusted back to equal weights, the trades generally involve selling stocks that have recently outperformed — and thus are more expensive than they were — and buying stocks that have recently underperformed — and are cheaper than they were. This regular readjustment creates a slight positive value bias.

Those exposures to diversification and value can be seen through the correlation with the market, the value premium and the size premium in the MSCI World Index.

The value premium is calculated as the difference between the MSCI Value Index and the MSCI Growth Index. The size premium is calculated as the MSCI Mid Cap Index minus the MSCI Large Cap Index. The MSCI Equal Weight index has a strong positive correlation with the size premium and a positive correlation with the value premium. As a comparison, the minimum volatility strategy also has positive correlations with the size premium and the value premium (see Figure 12).

**Figure 12: MSCI World Equal Weight Index — Diversification and Value Exposures**

| Correlations (%) | World | Value–Growth | Mid–Large |
|---|---|---|---|
| Equal Weight | 96 | 8 | 33 |
| Minimum Volatility | 89 | 12 | 16 |

Source: MSCI, 1998–2016.
The correlation coefficient measures the strength and direction of a linear relationship between two variables. It measures the degree to which the deviations of one variable from its mean are related to those of a different variable from its respective mean.

## Conclusion

Exposure to the size factor may provide an opportunity for investors to outperform a market cap index. This factor has a long history (close to 90 years), seems to provide a reasonable premium (perhaps 2 to 3 percentage points of outperformance) and can be found globally, regionally and in individual markets.

It should come as no surprise that the small cap premium exists — given higher trading costs, higher systematic risk, lower liquidity, information uncertainty, default risk and behavioral biases. This can be seen in the underperformance of market cap weight benchmarks such as the MSCI World Index and the S&P 500 Index relative to their equal weight equivalents over the medium to long term.

Interestingly, it appears that the equal weight strategy goes beyond the capture of small cap exposure to offer some diversification features through the reduction of specific risk. And the equal weight strategy is slightly biased toward value through the systematic readjustment process.

[1] See Jennifer Bender et al, "Foundations of Factor Investing," *MSCI Research Insight,* December 2013.

[2] Minimum volatility seeks to select a portfolio of securities that are expected to exhibit lower volatility relative to the index, with low exposure to market risk factors, such as beta, and with low security-specific risk.

[3] Decorrelation is any process that reduces autocorrelation (over time) or cross-correlation (between securities) within a portfolio.

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## Backtest Methodology

The backtested performance shown was created by the Global Equity Beta Solution teams at SSGA. The data used were only what would have been available at the time the historical portfolios were generated, not what is available now. These processes help to eliminate various forms of survivorship bias, both in terms of a "smarter model" and in terms of making decisions based on information that was not available at the time. The backtested performance depicted is not reflective of any SSGA investment product or Strategy, and is provided only as an illustrative example of nonspecific Smart Beta investment processes, over the period from April 1989 to June 2016.

The testing methodology is a rules-based process to generate historical portfolios. All stocks in the universe are ranked and allocated into different buckets according to their corresponding size scores. A multiplier is then applied to each bucket so that each stock's cap weight is tilted by this ratio. To form the final portfolio, the final security weight is then normalized such that the total weight sums to 100%.

The backtest results shown do not represent the results of actual trading using client assets but were achieved by means of the retroactive application of an investment process that was designed with the benefit of hindsight, otherwise known as backtesting. Thus, the performance results noted above should not be considered indicative of the skill of the advisor or its investment professionals. The backtested performance was compiled after the end of the period depicted and does not represent the actual investment decisions of the advisor. These results do not reflect the effect of material economic and market factors on decision making. In addition, backtested performance results do not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risks associated with actual investing.

No representation is being made that any client will or is likely to achieve profits or losses similar to those shown. In fact, there are frequently significant differences between backtested performance results subsequently achieved by following a particular strategy.

The backtested performance may be reported on a gross of fees basis. Additional fees, such as the management fee, would reduce the return of an investment product that used one of these investment processes. For example, if an annualized gross return of 10% was achieved over a 5-year period and a management fee of 1% per year was charged and deducted annually, then the resulting return would be reduced from 61% to 54%. The performance includes the reinvestment of dividends and other corporate earnings and is calculated in US dollars.

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Companies with large market capitalizations go in and out of favor based on market and economic conditions. Larger companies tend to be less volatile than companies with smaller market capitalizations. In exchange for this potentially lower risk, the value of the security may not rise as much as companies with smaller market capitalizations.

Investing involves risk including the risk of loss of principal.

Investments in small/mid-sized companies may involve greater risks than in those of larger, better known companies.

Investing in foreign domiciled securities may involve risk of capital loss from unfavorable fluctuation in currency values, withholding taxes, from differences in generally accepted accounting principles or from economic or political instability in other nations.

Investments in emerging or developing markets may be more volatile and less liquid than investing in developed markets and may involve exposure to economic structures that are generally less diverse and mature and to political systems which have less stability than those of more developed countries.

A factor-based strategy does not seek to replicate the performance of a specified cap-weighted index and as such may underperform such an index. The factors to which a factor-based strategy seeks to deliver exposure may themselves undergo cyclical performance. As such, a factor-based strategy may underperform the market or other factor-based strategies exposed to similar or other targeted factors. In fact, we believe that factor premia accrue over the long term (5-10 years), and investors must keep that long time horizon in mind when investing.

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These investments may have difficulty in liquidating an investment position without taking a significant discount from current market value, which can be a significant problem with certain lightly traded securities.

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