How to use factor-based investing in your portfolio

Factors are the underlying exposures that explain and influence an investment's risk.[1] Equity factor-based investing is a form of active management, usually at a lower cost.

Equity factor-based investing can be used when constructing portfolios in various ways, depending on your goals. Those include: enhanced return, reduced volatility, active fund substitution, and portfolio completion.

We highlight five key implementation decisions in the construction of factor-based products.

You have heard about factor-based investing for some time. You are aware that some factors have shown significant outperformance over long periods. You may be interested in using factors in your portfolios, but you wonder about how to choose among a bevy of products and how to implement factors for different goals and needs.

The full research paper, *Equity factor-based investing: A practitioner's guide*,[2] thoroughly discusses many of the considerations for factor investing. This brief highlights some of the more common factor exposures as well as summarises the portfolio construction and implementation points in the research paper.

Six common stock factor exposures

Value Stocks with lower ratios of price relative to different fundamentals (earnings, book value, etc.) have tended to earn a higher return over time than those with higher ratios.	**Size** Stocks of small companies have tended to earn a higher return than stocks of large companies.
Momentum Stocks with strong recent performance have tended to earn a higher return than those with weak recent performance.	**Volatility** Stocks with lower volatility have typically produced a higher risk-adjusted return than those with higher volatility.
Liquidity Stocks with less liquidity have tended to outperform stocks with higher liquidity.	**Quality** Stocks of companies with stronger operations, earnings, and balance sheet quality, have tended to earn a higher return than those that do not.

1 Scott N. Pappas and Joel M. Dickson, 2015. *Factor-based investing*. Valley Forge, Pa.: The Vanguard Group.
2 Douglas M. Grim, Scott N. Pappas, Ravi G. Tolani, and Savas Kesidis, 2017. *Equity factor-based investing: A practitioner's guide*. Valley Forge, Pa.: The Vanguard Group.

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Benchmarks represented in this analysis

		Index inception date	Index-live date
Liquidity (lower)	FTSE Developed Illiquidity Factor Index	30/9/01	11/8/15
Momentum (higher)	MSCI World Momentum Index	31/5/73	11/12/13
Quality (higher)	MSCI World Quality Index	28/11/75	18/12/12
Size (lower)	MSCI World Small Cap Index	29/12/00	1/1/01
Value (higher)	MSCI World Enhanced Value Index	28/11/97	11/8/14
Volatility (lower)	MSCI World Minimum Volatility Index[2]	31/5/88	14/4/08

Notes: The index inception date is the date that back-filled performance data are first available for the index. The index-live date is the date that an index is first published to the public and starts calculations using live data. The MSCI World Value Index, with an inception date of 31 December 1974 and an index-live date of 8 December 1997, was used to represent value for periods prior to 30 November 1997. Any back-tested results are based on criteria applied retroactively with the benefit of hindsight and knowledge of issues that may have positively affected its performance, and cannot account for all financial risk that may affect the actual performance of the strategy. The actual performance may vary significantly from the back-tested results. For more information on index construction methodologies, please visit ftse.com and msci.com.

Certain factors have outperformed over time

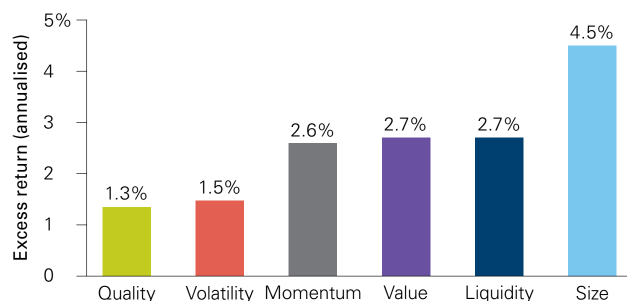
Figure 1 shows how particular factors have outperformed the broad equity market over time. Yet, despite the potential benefits of factors, you should remember that any long-term success will likely demand patience to endure the nearly inevitable periods of underperformance, no matter how the products are constructed or used.

As with other types of active strategies, a bumpy road to outperformance

Similar to many forms of active management, factors can perform inconsistently. Sometimes individual factors can significantly underperform.

Figure 2 shows the year-by-year performance of common factors over 14 years.

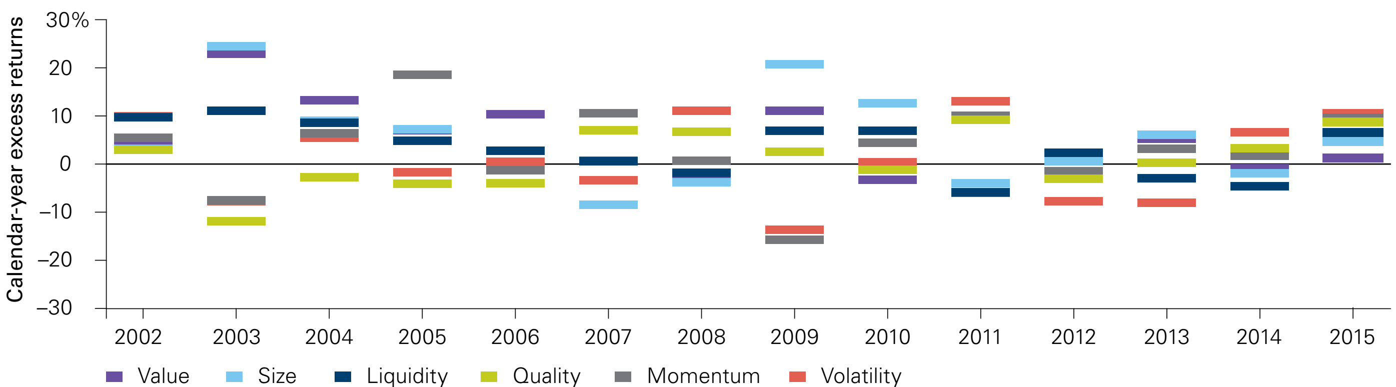
Figure 1. Different equity factor tilts have outperformed historically



Notes: Excess returns are calculated relative to the MSCI World Total Return Index (USD). All results are as at 30 September 2016. MSCI World Momentum Index (USD) history begins 31 May 1973; MSCI World Value Index (USD) is from 31 December 1974 to 30 November 1997, and MSCI World Enhanced Value Index thereafter; MSCI World Quality Index (USD) begins 30 November 1975; MSCI World Minimum Volatility Index (USD) begins 31 May 1988; MSCI World Small Cap Index (USD) begins 31 December 2000; and FTSE Developed Illiquidity Factor Index (USD) begins 30 September 2001. This figure includes back-tested index performance. For information regarding index inception dates and index-live dates, please see table above.

Sources: Vanguard calculations, using data from Thomson Reuters Datastream, MSCI, Bloomberg, and FTSE.

Figure 2. Equity factor tilt relative performance has been inconsistent historically



Notes: Data cover 1 January 2002 through 31 December 2015. Excess returns are calculated relative to the MSCI World Total Return Index (USD). This figure includes back-tested index performance. For information regarding index inception dates and index-live dates, please see table above.

Sources: Vanguard calculations, using data from Thomson Reuters Datastream, MSCI, Bloomberg, and FTSE.

Approaches to factor-based investing in portfolios

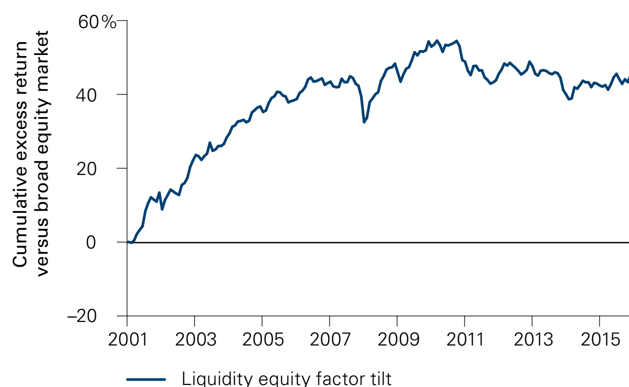
How to use factors when constructing a portfolio depends on your goals. You may seek out-performance, or you may want to reduce risk. Factor-based products can also substitute for higher-cost active management or fill gaps to complete a portfolio. Following are four examples of how certain factor-based investing strategies can be used for each goal.

1. Outperformance: Use a factor tilt

You could use a static, equity factor tilt as a systematic approach to potentially generate outperformance. **Figure 3** shows how this liquidity factor tilt has performed historically. Implementation costs should be considered before making a product choice.

Understand that there will likely be intermittent sizable performance cyclicality over the short and intermediate term, which will require behavioural coaching. If you have previously demonstrated a tolerance for active risk, you may feel more confident that you can handle potential future periods of underperformance against the broad equity market.

Figure 3. Liquidity equity factor tilt has outperformed historically



Note: All calculations are relative to the MSCI World Total Return Index (USD) and cover 30 September 2001 through 30 September 2016. This figure includes back-tested index performance. For information regarding index inception dates and index-live dates, please see table on page 2.

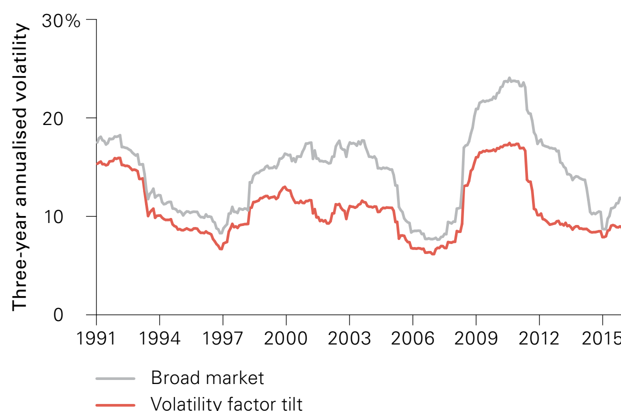
Sources: Vanguard calculations, using data from Thomson Reuters Datastream and FTSE.

2. Reduce risk: Use a low-volatility tilt

It is possible to lessen total volatility with a minimal reduction in return.

A global low-volatility-tilted vehicle can help achieve this objective. **Figure 4** shows that the standard deviation of the volatility factor tilt was lower than that of the broad market from 1988 to 2016. On average, the reduction in volatility was 24%. Although a low-volatility vehicle may help reduce absolute risk in the portfolio over the long term, it will produce high tracking error versus the broad equity market, which will require a strong tolerance for this type of risk. You will need to set reasonable performance expectations.

Figure 4. Volatility equity factor tilt has exhibited consistently lower absolute volatility



Notes: Calculations are based on the three-year annualised standard deviation of returns and cover 31 May 1988 through 30 September 2016. The broad market is represented by the MSCI World Total Return Index (USD). This figure includes back-tested index performance. For information regarding index inception dates and index-live dates, please see table on page 2.

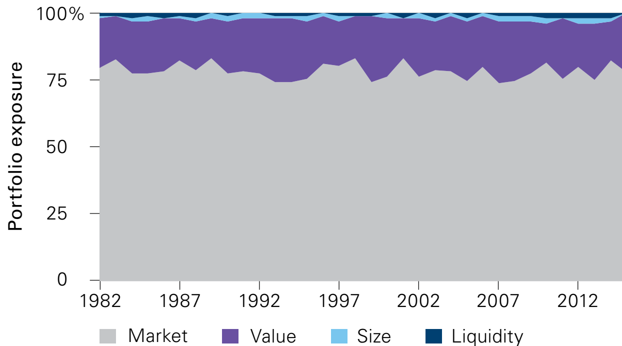
Sources: Vanguard calculations, using data from Thomson Reuters Datastream, MSCI, and Bloomberg.

3. Substitution: Replace higher-cost active

You may discover that a particular manager's returns are largely explained by common factor exposures. A manager who is benchmarked against a broad equity market index may simply be maintaining a relatively consistent factor tilt to value over time, as shown in the hypothetical returns-based style analysis in **Figure 5**.

You may also find the manager has not produced any additional return through either security selection or market-timing to overcome a high-cost hurdle. Consequently, you could replace the manager with a broad-market index vehicle paired with a low-cost, value-factor-tilted equity product that is more transparent.

Figure 5. Hypothetical returns-based style analysis shows a consistent value factor for a certain traditional active manager



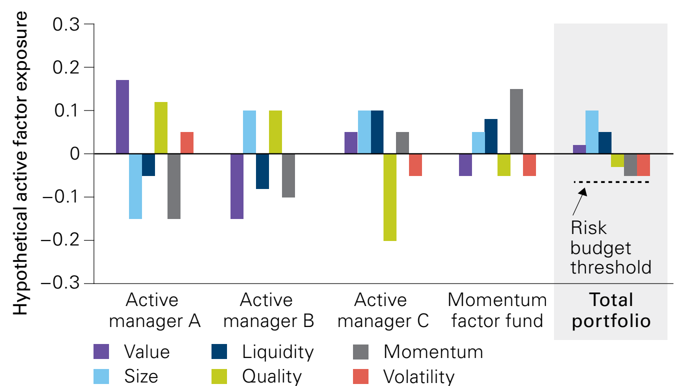
Note: This example is hypothetical and does not represent the exposures for a specific traditional active manager. The figure shows that the manager did not showcase any quality, momentum, or volatility exposure over the period, and that the exposure to size and liquidity was de minimis.

Source: Vanguard.

4. Completion: Fill in where needed

A portfolio could use an active-passive strategy by holding broad market-capitalisation-weighted index vehicles and employing traditional active equity managers to invest in equities. During an annual review, you might find that the portfolio has negative exposure to the momentum factor. To complete the portfolio, you could decide to sell a portion of the assets allotted to each traditional active manager and put the proceeds in a momentum-factor-tilted fund. **Figure 6** demonstrates the resulting factor exposures in the proposed portfolio. By adding the factor fund, the inadvertent momentum underweight has been reduced to fit within an expected active-risk budget.

Figure 6. Proposed equity portfolio would have no factor exposures that violate risk budget thresholds



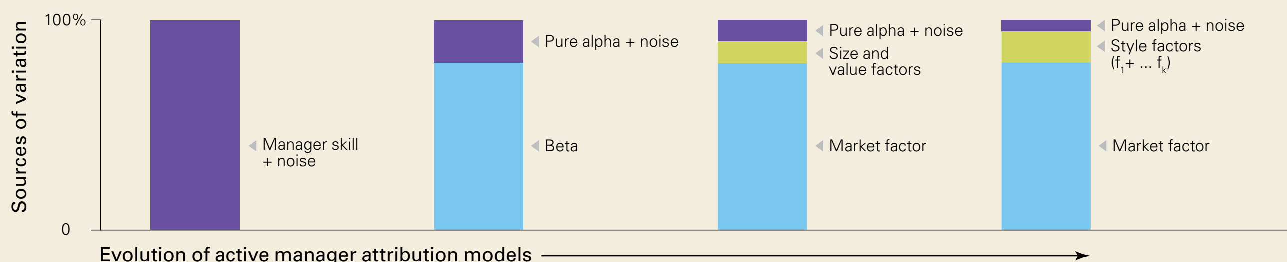
Note: The portfolios shown are hypothetical and are used for purposes of illustration only.

Source: Vanguard.

A higher bar for active management

The ability to cheaply replicate systematic factor returns has raised the performance hurdle for both traditional and quantitative active equity managers. **Figure 7** displays the evolution of active manager performance attribution over time. To justify charging higher fees, traditional active managers must be capable of generating returns in excess of those of broad-market indices and low-cost factor-tilted vehicles.[3] Ultimately, this evolution provides a better understanding of the true source(s) of active manager returns and risk and, as a result, helps you consider the appropriate fee level for different sources of return.

Figure 7. Equity attribution models have evolved to distinguish factor exposure contribution from true alpha contribution



Notes: This is a hypothetical scenario for illustrative purposes only. It does not represent any particular equity investment. "Noise" refers to the fact that through any period, some degree of randomness always affects results versus the broad equity market. The degree of influence varies and can be difficult to statistically distinguish from alpha without extensive data.

Source: Vanguard.

3 The primary goal must be focused on generating pure alpha through unique insight. Bender, Hammond, and Mok found that up to 80% of the excess return generated by active managers can be explained by systematic factor exposures (Jennifer Bender, Pl. Brett Hammond, and William Mok, 2014. Can alpha be captured by risk premia? *The Journal of Portfolio Management* 40(2):18–29). Even without any additional factors considered beyond the Fama-French Three-Factor Model, historically it has been challenging for active equity managers to outperform the market. (Garrett L. Harbron, Daren R. Roberts, and James J. Rowley Jr., 2016. *The case for low-cost index-fund investing.* Valley Forge, Pa.: The Vanguard Group; Eugene F. Fama and Kenneth R. French, 2010. Luck versus skill in the cross-section of mutual fund returns. *The Journal of Finance* 65(5):1915–47).

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Portfolio construction and due diligence

We have outlined five key choices when constructing factor-based products. Using different methods when building factor-based investing products can mean significant variations in performance, so rigorous due diligence is required.

1. Weighting options

- *Market capitalisation* can be used after factor screens are applied. Compared with other weighting options, returns from market-cap products should be most strongly correlated with market returns.
- *Alternatively weighting* sets stock weightings largely based on a stock's sensitivity to the desired factor or factors. Such products' returns would be less correlated with market returns.
- *Long-short construction* would hold stocks that meet factor guidelines and short stocks that show characteristics distinctly different from the chosen factor or factors. Such products provide nearly "pure" factor exposure, but their returns would be uncorrelated with market returns and they would be potentially expensive to implement.

Figure 8 highlights some key differences between these methods.

2. Exposure

- *Global equities* provide increased market and currency diversification, which potentially lowers volatility. In addition, factor returns across countries are not perfectly correlated.
- *Single country equities* allow flexibility to customise the country and currency allocation.

3. Index or actively managed

- *Index construction* offers high transparency, typically lower costs, and mechanical operation.
- *Active construction* can include active selection of equities in an attempt to add value over the desired factor and active implementation in an attempt to maintain more consistent factor exposure.

4. Single or multifactor

- *Single factors* can be used alone to tilt the portfolio to a desired factor or in combination with other single-factor products.
- *Multifactor* products offer potential diversification benefits that can be garnered through merging equity factor tilts. Multifactor products can reduce the active risk associated with exposure to a single factor but offer limited diversification benefits when compared with the broad market.

5. Multifactor construction

- *Top-down* construction means that investments are made in separate vehicles, with each targeting a single factor. You can decide which factors to include, what types of products to choose, and how much to allocate to each factor.
- *Bottom-up* construction is based on a selection of equities that provide positive exposure to the desired factors, usually combined into a single product. This technique may lead to lower turnover and can ensure that chosen stocks are not inadvertently tilted against the targeted factors.

Figure 8. The security-level weighting choice has numerous implications

Key differentiating characteristics	Market-cap weighted	Alternatively weighted	Long-short
Factor sensitivity	Lower	Medium	Higher
Turnover/transaction costs	Lower	Medium	Higher
Expenses	Lower	Medium	Higher
Correlation with broad equity market	Higher	Higher	Lower

Higher Medium Lower

Note: Points of differentiation in this table are considered relative to one another.
Source: Vanguard.

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