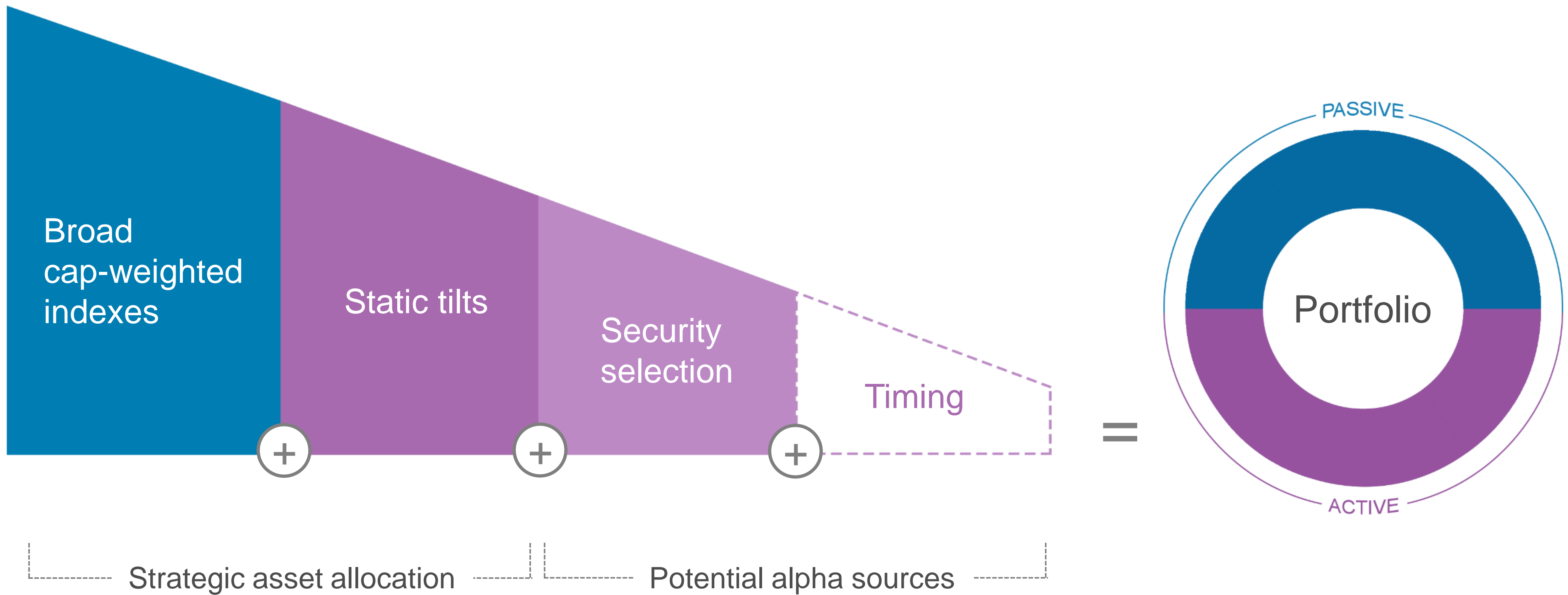
Quantitative Investment: From indexing to factor investing

Vanguard

What's the prudent portfolio mix? It depends

Notes: The allocations in each pie chart are for purposes of illustration only and are not intended as specific recommendations. Any actual portfolio recommendations would be determined using investor-specific criteria. For more on this topic, see the Vanguard research paper *A Framework for Institutional Portfolio Construction*, 2016.
Source: Vanguard.

A framework for portfolio construction

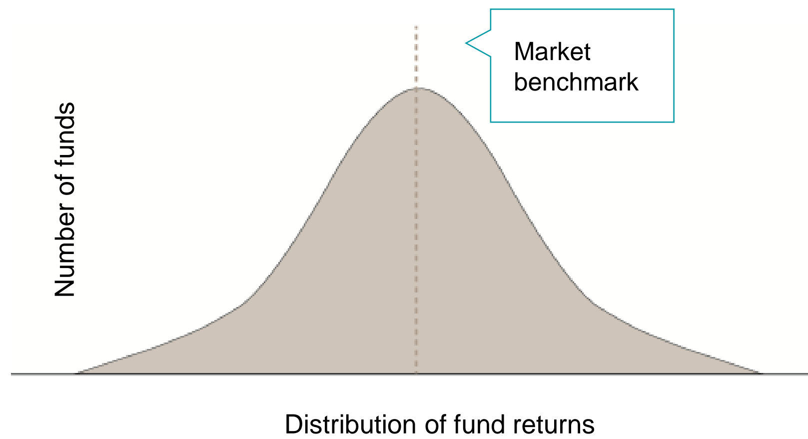


Note: For more on this topic, see the Vanguard research paper *A Framework for Institutional Portfolio Construction*, 2016.
Source: Vanguard.

Quantitative investing: Indexing

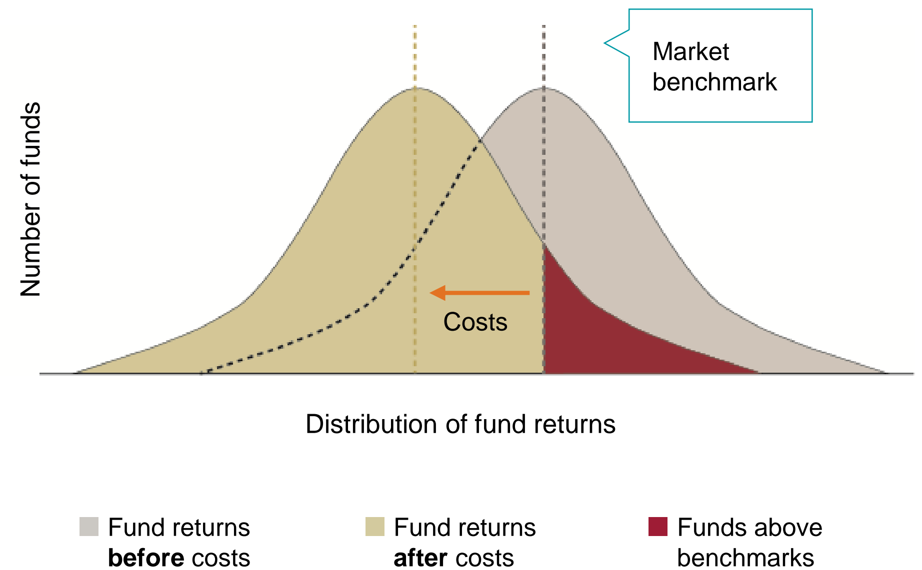
The key to indexing: Low costs

- Investing is a zero-sum game before costs



The holdings of all investors aggregate to form a market. Outperformance by one investor necessarily means underperformance by another.

- Investing is a negative-sum game after costs



After costs, a majority of investors will underperform the market benchmark. The key to long-term, consistent success is low-cost investing.

Is there an ex-ante metric that can improve the odds?

Cost is a powerful indicator of future alpha

Relative difference in median ten-year annualized alpha

1.5%
1.0%
0.5%
0.0%
-0.5%

Not statistically significant

Expense ratio	Turnover	Tracking error	Fund concentration	Fund size	Past alpha	Number of holdings	Sharpe ratio
1.18%	0.66%	0.58%	0.26%	-0.15%	-0.15%	-0.20%	-0.21%

Median of lowest-quartile metric funds outperformed

Median of highest-quartile metric funds outperformed

Notes: The bars represent the difference in the median annual alpha from January 1, 2006, through December 31, 2016, of mutual funds in the lowest and highest quartiles, based on the above metric measurements from January 1, 2004, through December 31, 2006. Fund concentration is measured as the percentage of assets in the top ten holdings. The expense ratio and turnover were the only variables significant at the 99% confidence level. For more information, see the Vanguard research note *Shopping for Alpha: You Get What You Don't Pay For*, 2015.
Sources: Vanguard calculations, based on data from Morningstar, Inc., and Fama-French factor data.

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Tracking the indexes

Steps to keep our portfolios on track with benchmarks

- Proprietary system designed to neutralize the major risk factors
- Limit orders help minimize transaction costs
- Futures contracts help provide liquidity
- Portfolio holdings rebalanced daily
- Cash positions equitized daily

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Comprehensive risk assessment

- Vanguard exercises ongoing rigorous risk control

Individual stock level

Daily evaluation of security weights relative to the index

Factor level

Daily monitoring of sector weights, market capitalization, volatility, and style relative to the index

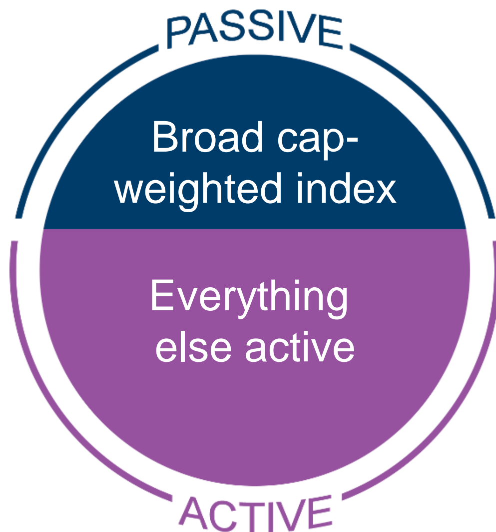
Portfolio level

Daily analysis of portfolio characteristics and ongoing rebalancing to match benchmark characteristics

Sample imbalance report for individual holdings

Ticker	Shares held	Recent price	Market value	Portfolio wt.	Index wt.	% Imbalance	Dollar imbalance	Share imbalance
SPG	2,425,936	36.780	$89,225,926	0.12977	0.12808	–0.00169	–1,162,840	–31,700
MCO	1,838,772	23.410	$43,045,653	0.06260	0.06167	–0.00093	–639,270	–27,400
RHI	1,468,728	18.900	$27,758,959	0.04037	0.03956	–0.00081	–558,419	–29,600
GWW	612,161	73.600	$45,055,050	0.06553	0.06476	–0.00077	–527,711	–7,200
ALTR	2,815,015	18.400	$51,796,276	0.07533	0.07463	–0.00070	–484,199	–26,400
CI	2,603,008	18.640	$48,520,069	0.07057	0.06986	–0.00070	–482,218	–25,900
DRI	1,313,981	37.010	$48,630,437	0.07073	0.07011	–0.00062	–423,549	–11,500

Quantitative investing: factors



Active investing is any investment strategy that is not broad market-cap-weighted.

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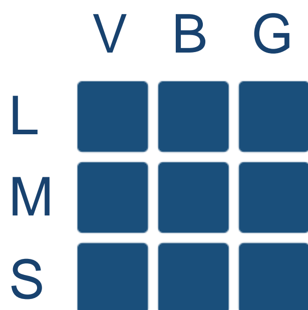
Factors are the DNA of an investment portfolio.

They are the underlying characteristics that explain and influence an investment's risk.

Equity factor-based investing is a systematic, diversified, and disciplined form of active management that intentionally targets consistent exposure to one or more well-known factors that have reasonable odds of helping an investor meet an objective.

Equity exposure should be evaluated through different lenses



Style

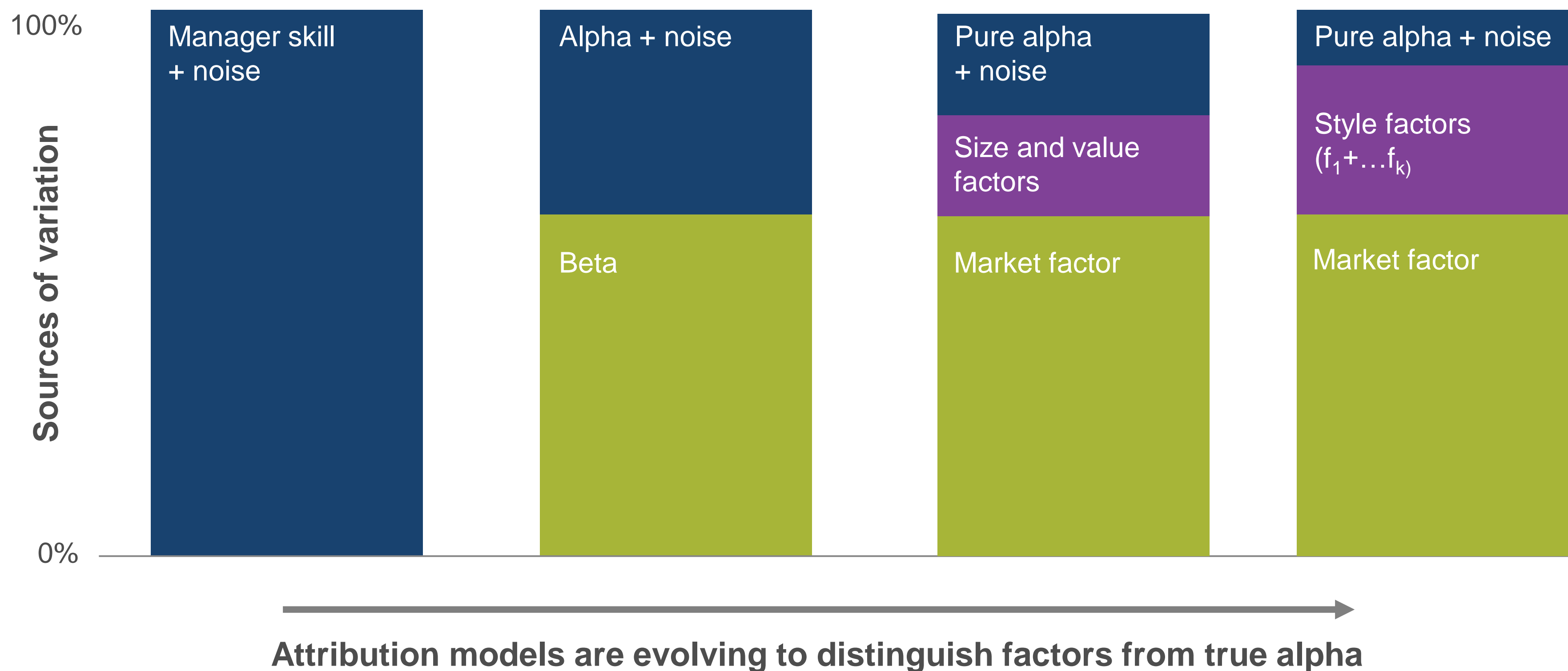
Location

Sectors

Factor

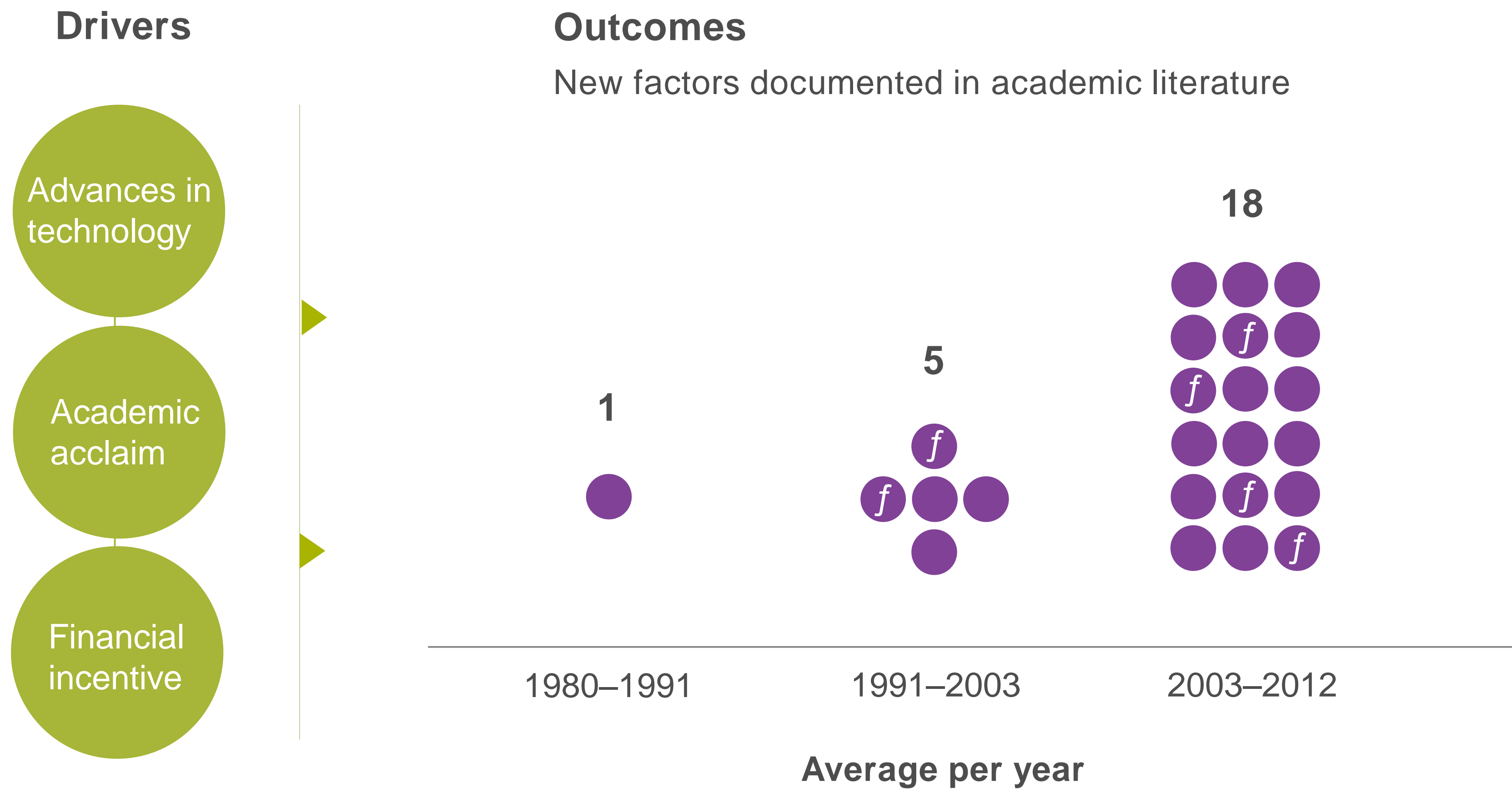
Factors are raising the bar for traditional active management

Advances in research and technology and low-cost factor vehicles are raising the bar for traditional active management



Note: The scenario shown is hypothetical and is for purposes of illustration only.
Source: Vanguard.

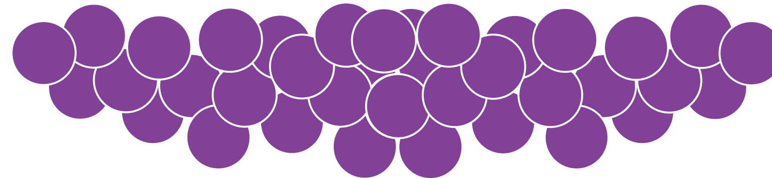
Equity factors that supposedly generate excess return have proliferated



Source: For the outcomes and time periods only, Campbell R. Harvey, Yan Liu, and Heqing Zhu, 2016, …And the Cross-Section of Expected Returns, *The Review of Financial Studies* 29 (1), 5-68.

Which, if any, may benefit investors in the future?

300+ documented characteristics today



Enduring logical rationale
Risk-based and/or behavioral reason(s)

Extensive empirical evidence
Out-of-sample tests, breadth of academic studies, etc.

Investability
Real-world implementation costs

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“Academic” results don’t equal real-world portfolio results

Academic papers often . . .

Test long/short, not long-only strategies

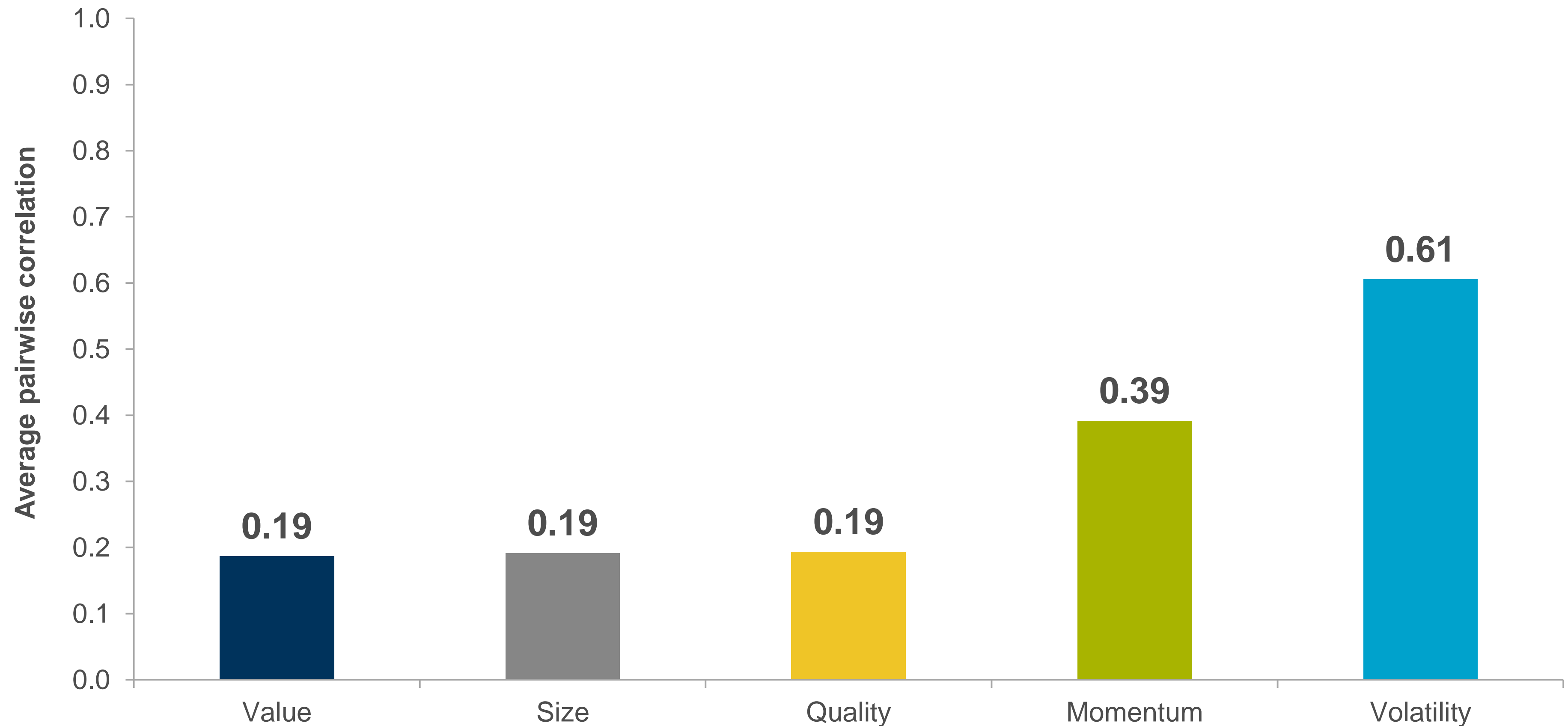
Ignore management and oversight expenses

Disregard transaction-related costs

Relative performance has been inconsistent over the short term

Notes: Data cover January 1, 2002, through December 31, 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 and index-live dates, please see the table in the Appendix.
Sources: Vanguard calculations, using data from Thomson Reuters Datastream, MSCI, Bloomberg, and FTSE.

Diversifying factor exposure globally can yield benefits



Notes: All calculations cover monthly excess returns from December 31, 2001, through May 31, 2016, except for the volatility factor, which covers November 30, 2002, through May 31, 2016. Country factor indexes included in the analysis are for the United States, United Kingdom, and Japan.
Sources: Vanguard calculations, based on data from Thomson Reuters Datastream and MSCI.

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Single or multifactor? Low correlation of excess returns can diversify active risk

Correlation of monthly excess returns, 2002–2016

	Value	Quality	Volatility	Momentum	Size	Liquidity
Value						
Quality	–0.59					
Volatility	–0.38	0.49				
Momentum	–0.11	0.37	0.37			
Size	0.43	–0.30	–0.15	0.10		
Liquidity	0.57	–0.44	–0.13	0.08	0.63	

High: > 0.7 Medium: 0.3–0.7 Low: < 0.3

Notes: Data cover December 31, 2001, through September 30, 2016. 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 and index-live dates, please see the table in the Appendix.
Sources: Vanguard calculations, using data from Thomson Reuters Datastream, MSCI, Bloomberg. and FTSE.

What are your goals? Your path forward

Enhance return	Generate excess returns using a static tilt to a particular factor
Reduce risk	Lessen total volatility with a minimal reduction in return
Substitution	Represent a high-cost active manager's returns with a broad market index vehicle paired with one or more low-cost, factor-tilted equity products
Completion	Adjust a factor over/underweight within the portfolio by allotting assets to a factor-tilted strategy

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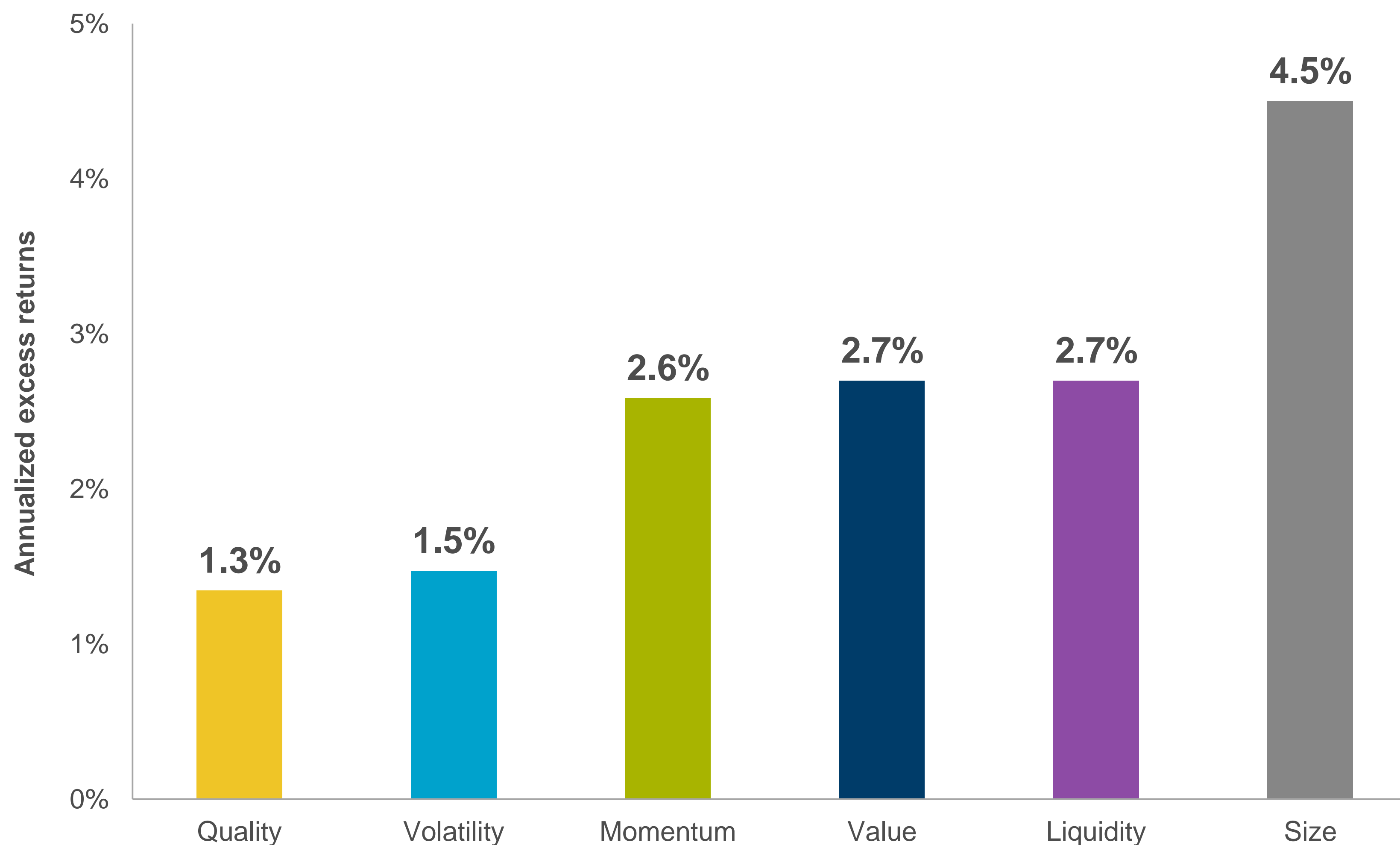
Role option 1: Static tilt—Enhance return

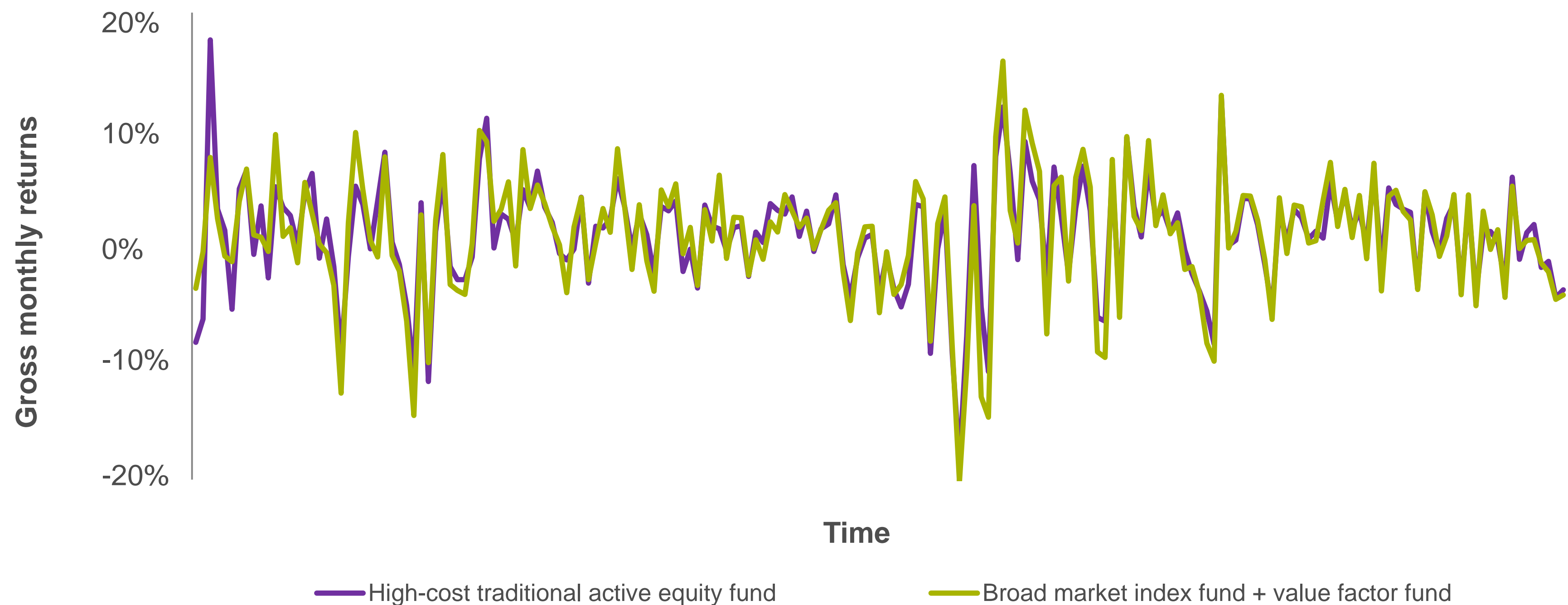
Numerous equity factor tilts have outperformed historically



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

Role option 3: High-cost traditional active manager substitution

Step 2: Try to represent the manager's performance while reducing costs



Note: The example shown is hypothetical, representing a period of several decades, and does not represent the exposures for a specific traditional active manager.
Source: Vanguard.

Conclusion

A form of active management

- Greater transparency
- More control
- Lower cost

Key considerations

- Persistence rationale
- Portfolio construction and implementation trade-offs
- Cost

Suitability depends on:

- Investment objectives
- Risk tolerance
- Due diligence capabilities