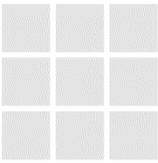




18th Annual Investment Innovation Conference
WHEN DIVERSIFICATION FAILS

Sébastien Page, CFA
Head of Global Multi-Asset
T. Rowe Price

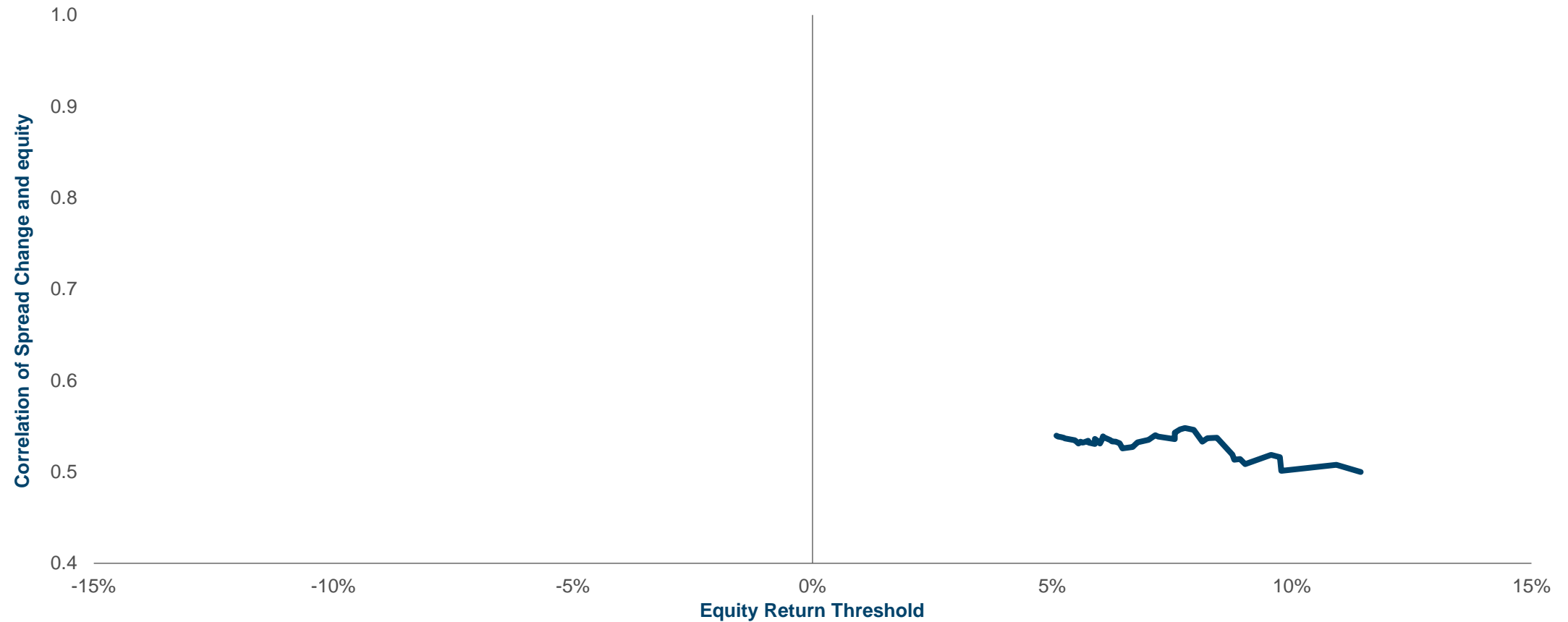
October 18, 2018



The Myth of Diversification

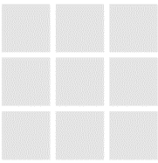
31 August 1989 Through 31 December 2016

CREDIT-EQUITY CONDITIONAL CORRELATIONS



Past performance is not a reliable indicator of future performance.

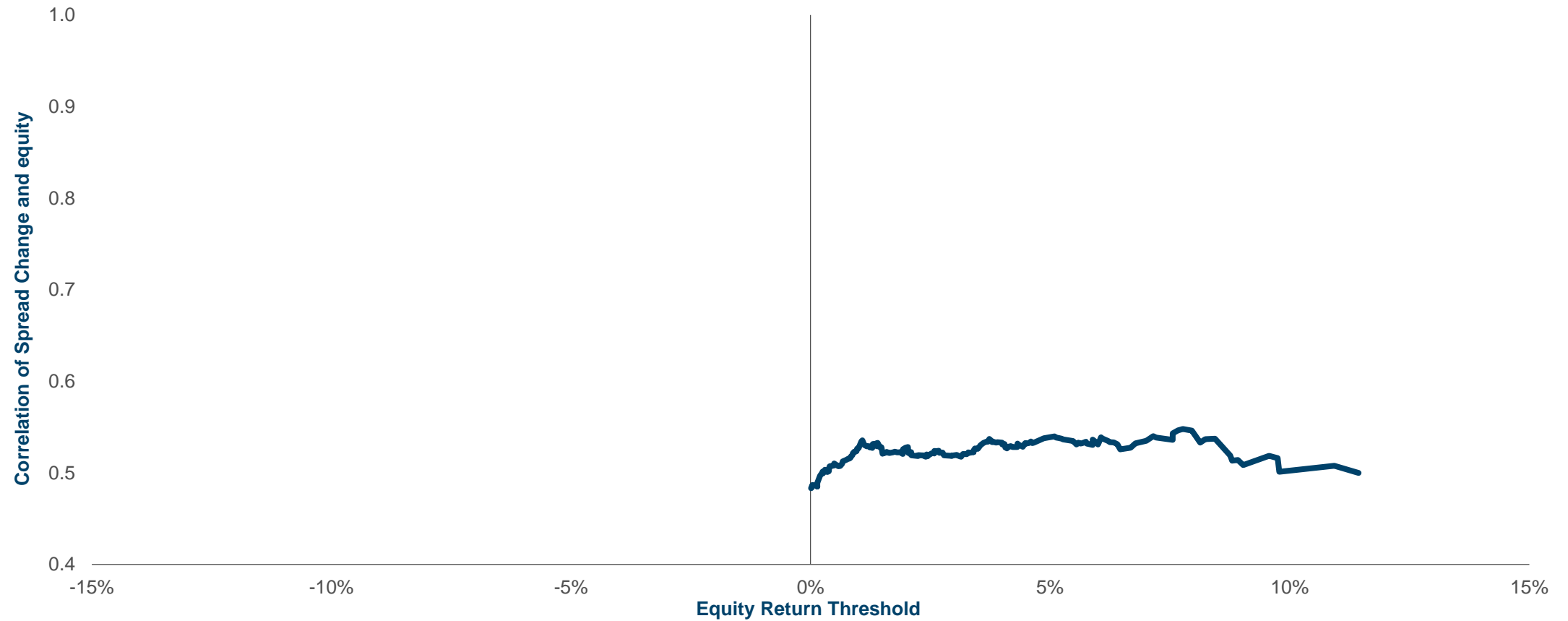
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The Myth of Diversification

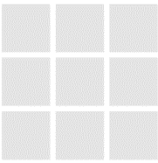
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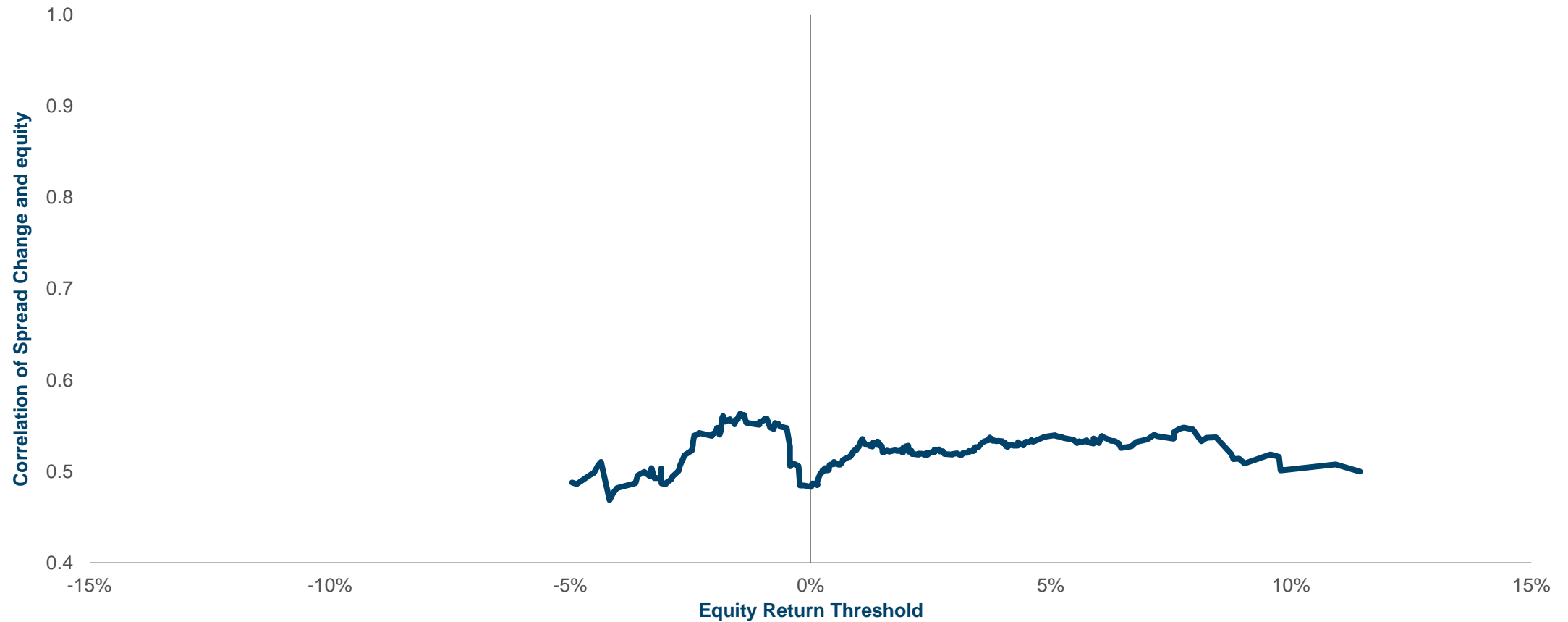
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The Myth of Diversification

31 August 1989 Through 31 December 2016

CREDIT-EQUITY CONDITIONAL CORRELATIONS



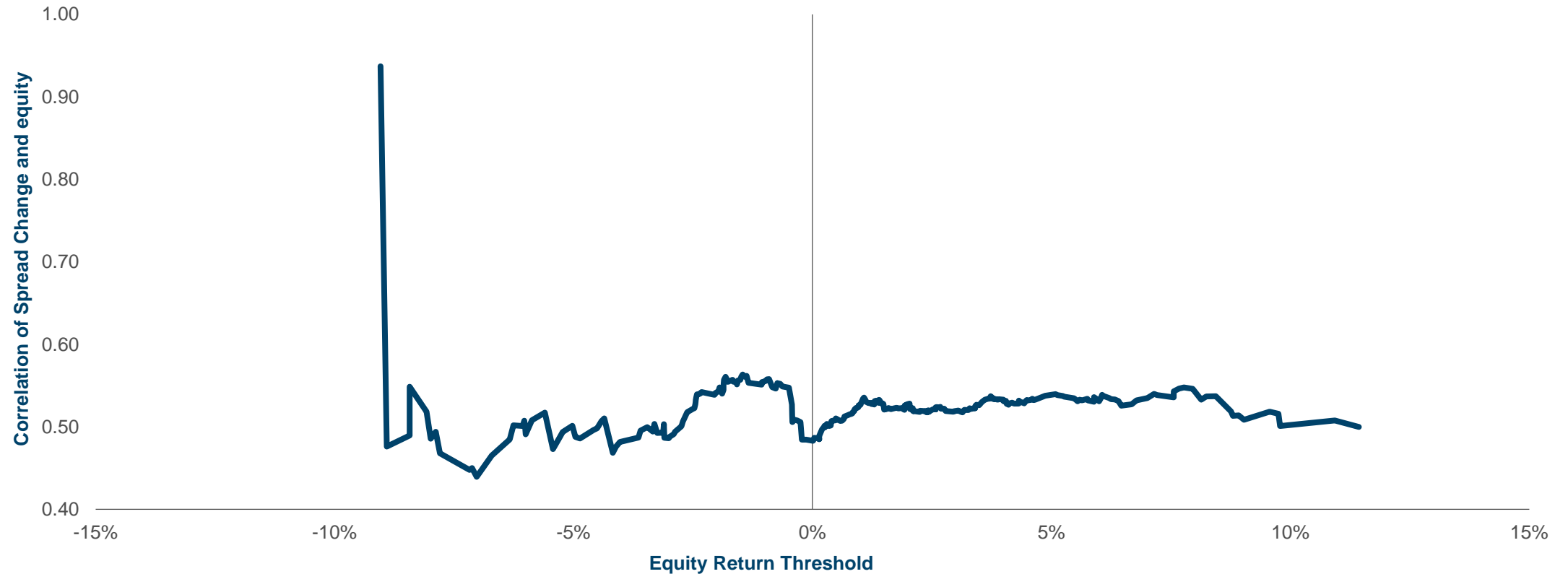
Past performance is not a reliable indicator of future performance.

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The Myth of Diversification

1 January 1970 Through 30 June 2017

CREDIT-EQUITY CONDITIONAL CORRELATIONS



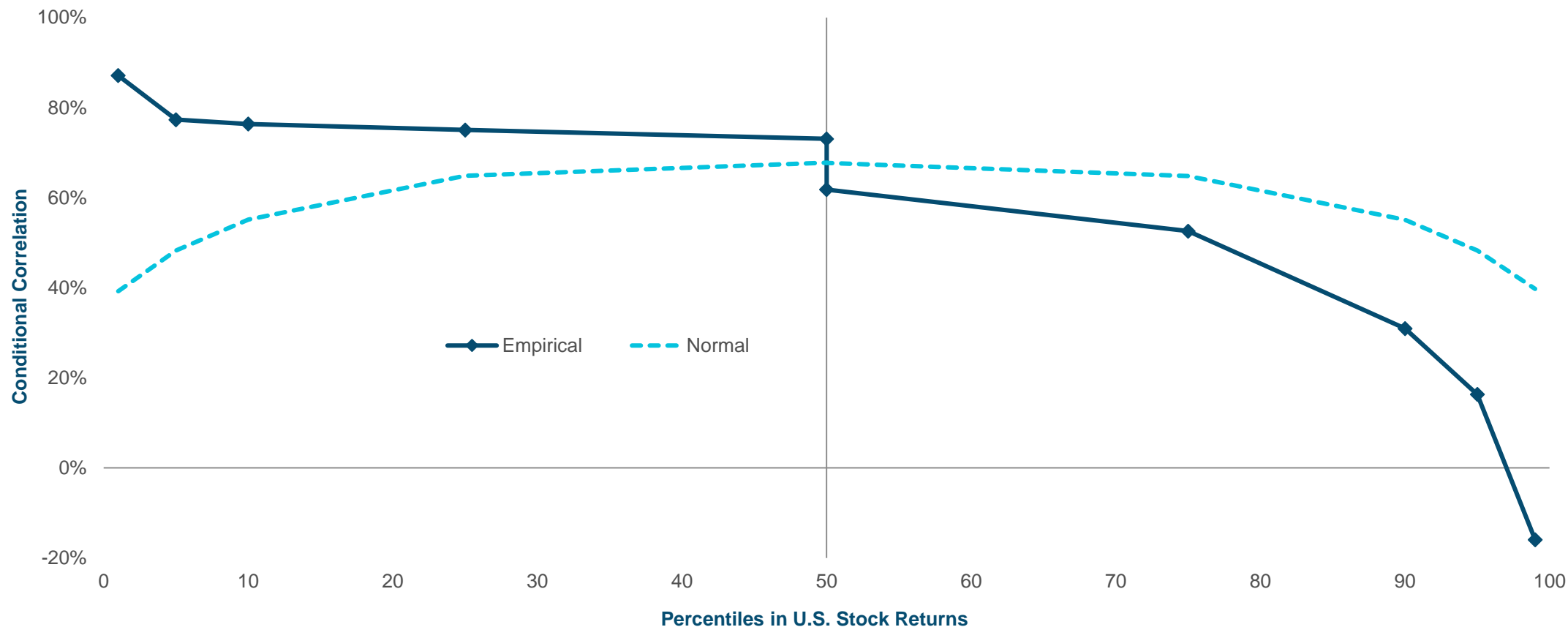
Past performance is not a reliable indicator of future performance.

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The Failure of Diversification in International Equity Portfolios

1 January 1970 Through 30 June 2017

CONDITIONAL CORRELATION PROFILE FOR US VS. NON-US STOCKS, JANUARY 1970-JUNE 2017



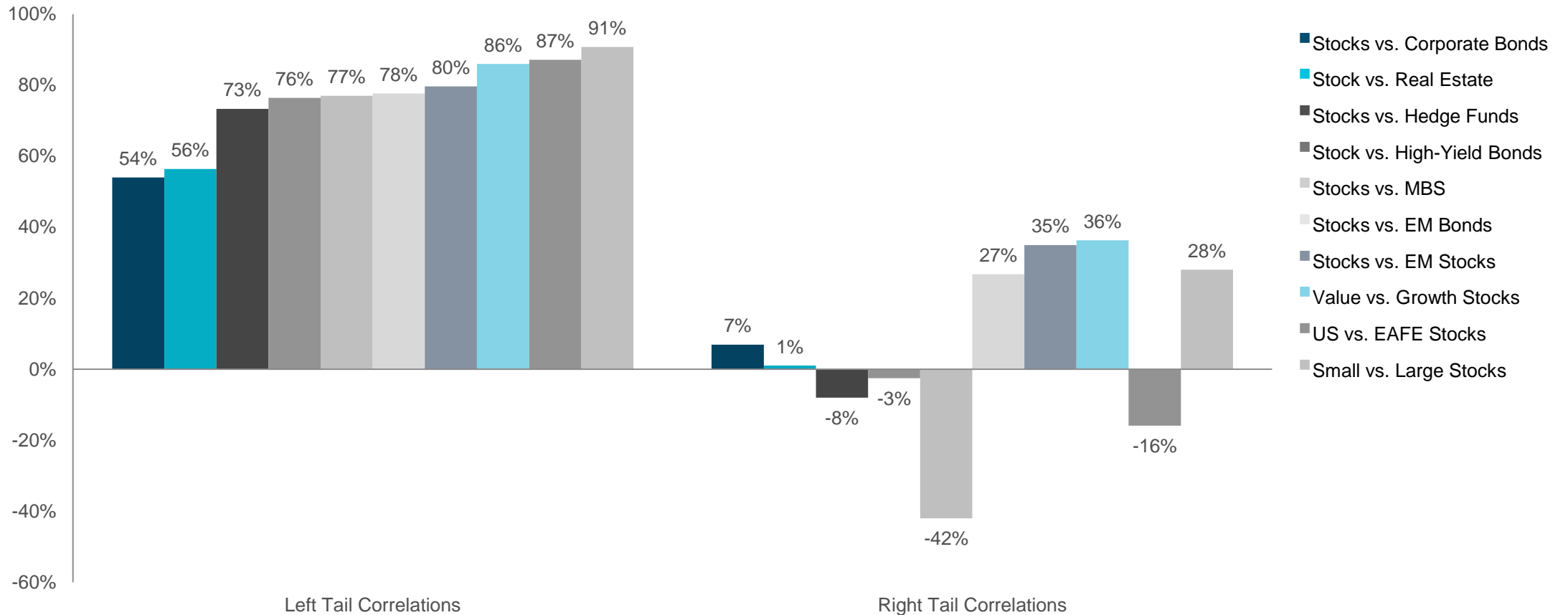
Past performance is not a reliable indicator of future performance.

US stocks are represented by the MSCI US Total Return Index, and non-US stocks are represented by the MSCI EAFE Total Return Index in local currency. Empirical conditional correlations were adjusted by the data-augmentation methodology. MSCI makes no express or implied warranties or representations about its data and has no liability whatsoever with respect to any MSCI data in this article. The MSCI data may not be further redistributed or used as a basis for other indexes or any securities or financial products. This report has not been approved, reviewed, or produced by MSCI.

The Failure of Diversification Across Risk Assets

As of 30 June 2017

LEFT-TAIL VS. RIGHT-TAIL CORRELATIONS FOR KEY RISK ASSETS

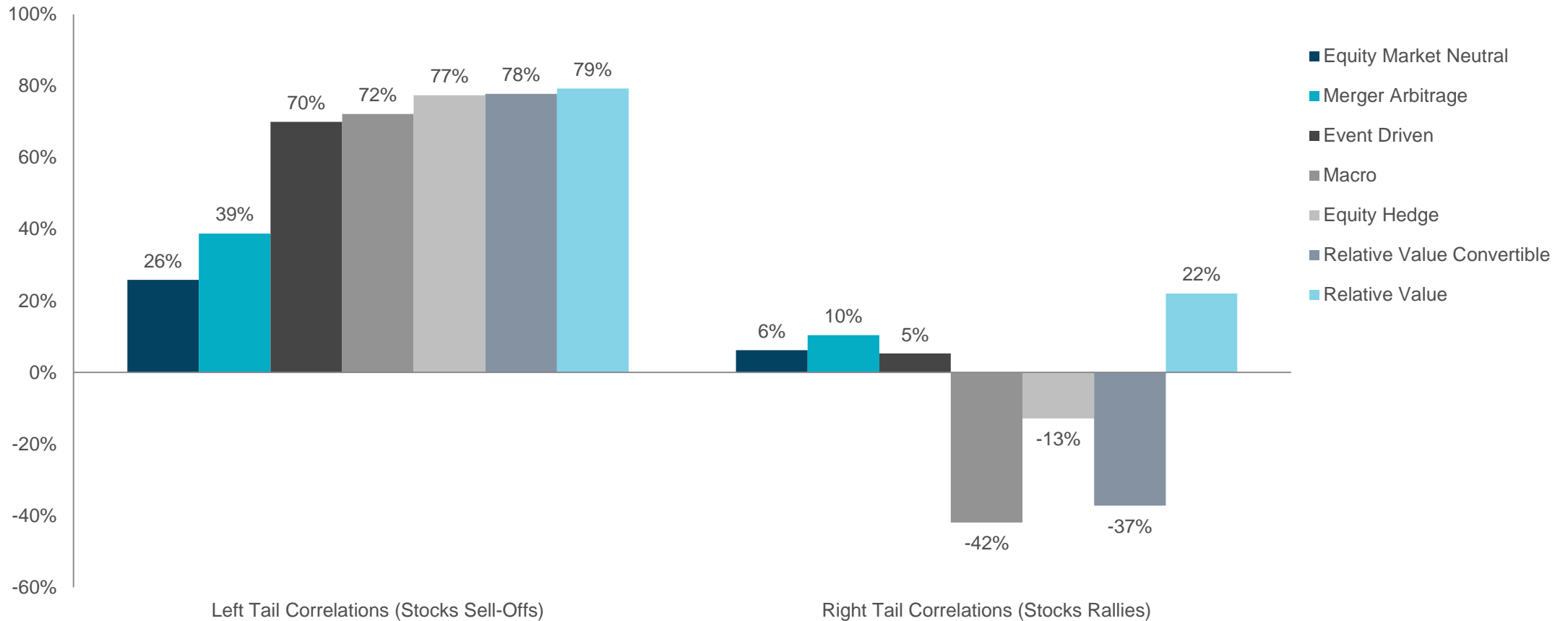


EM is emerging market. Left-tail and right-tail correlations are at the 1st and 99th percentiles but were adjusted by the data-augmentation methodology. See Appendix on page 17 for risk assets and data sources.

The Failure of Diversification in Hedge Funds

As of 30 June 2017

LEFT-TAIL VS. RIGHT-TAIL CORRELATIONS FOR HEDGE FUND STYLES

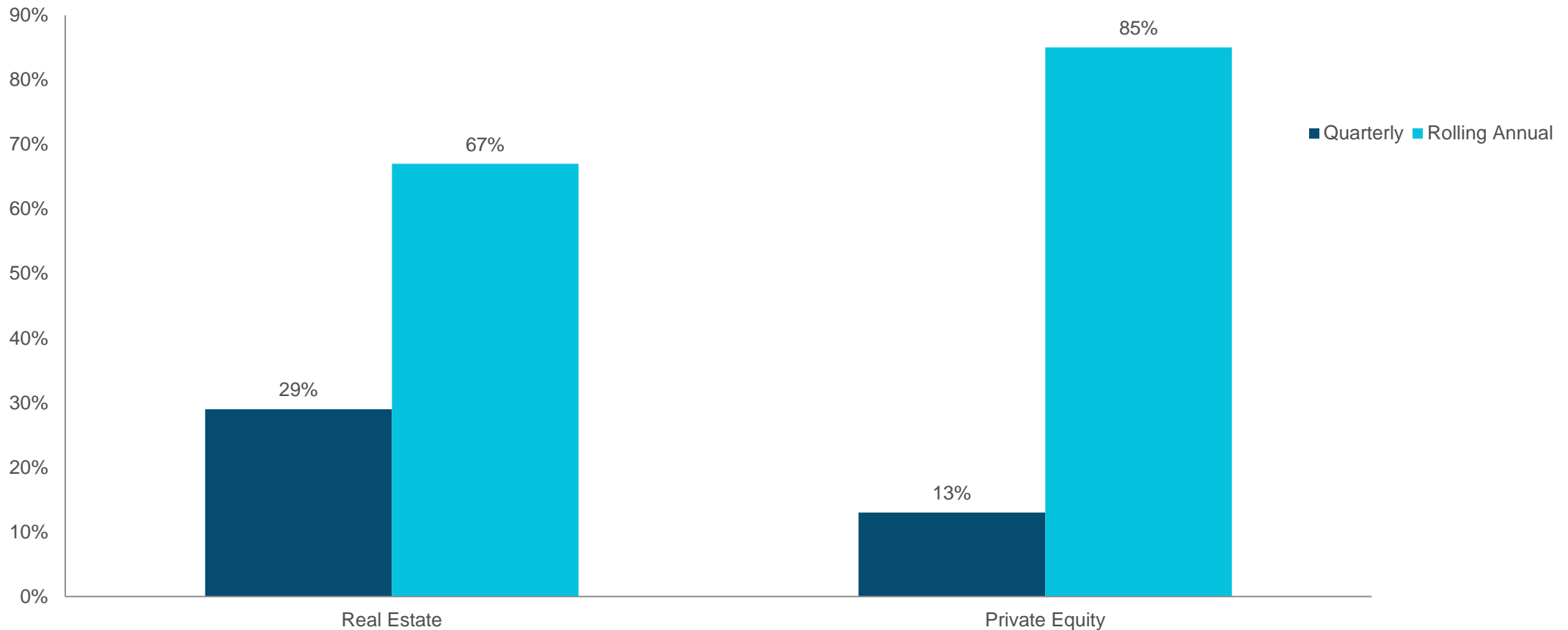


Left-tail and right-tail correlations are at the 1st and 99th percentiles but were adjusted by the data-augmentation methodology.
 See Appendix on page 17 for risk assets and data sources.

The Failure of Diversification in Private Assets

As of 30 June 2017

LEFT-TAIL CORRELATIONS WITH EQUITY FOR DIRECT REAL ESTATE AND PRIVATE ASSETS



Data shows quarterly vs. rolling annual data.

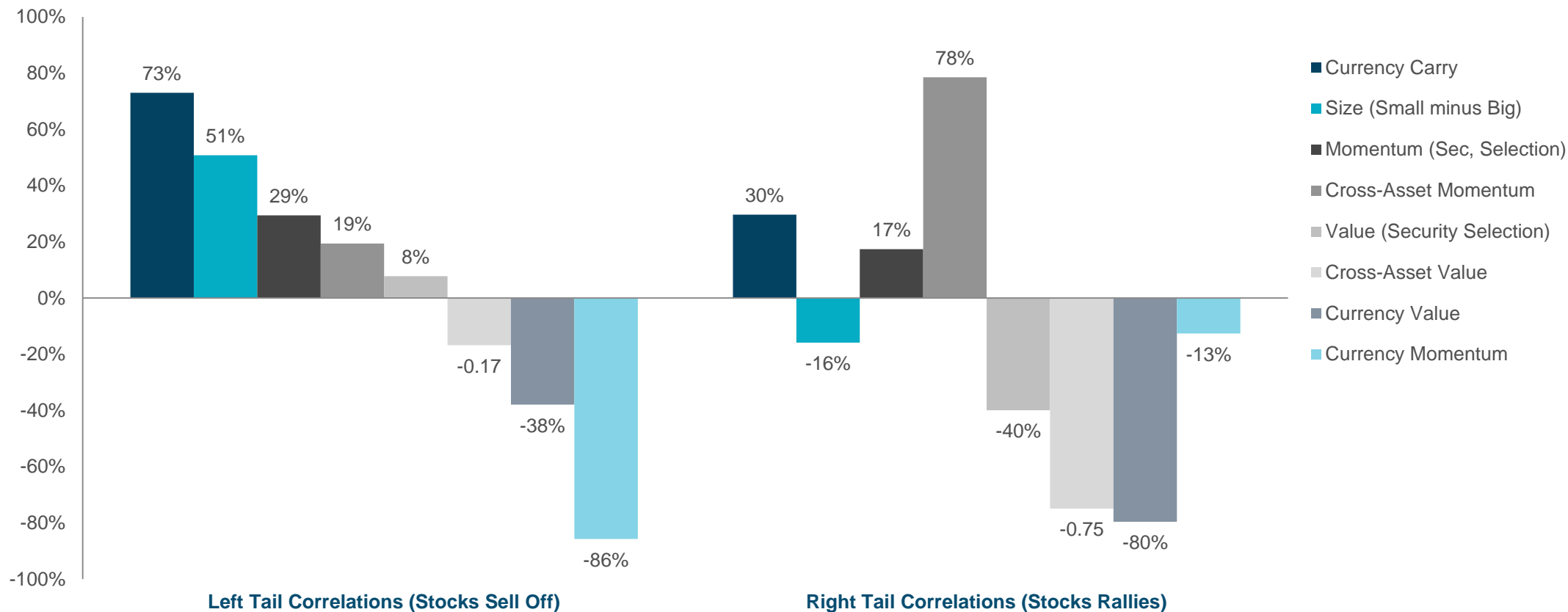
Left-tail correlations are at the 1st (bottom) percentile but were adjusted by the data-augmentation methodology.

See Appendix on page 17 for risk assets and data sources.

Risk Factors and the Benefit of Short Positions

As of 30 June 2017

LEFT-TAIL VS. RIGHT-TAIL CORRELATIONS FOR RISK FACTORS

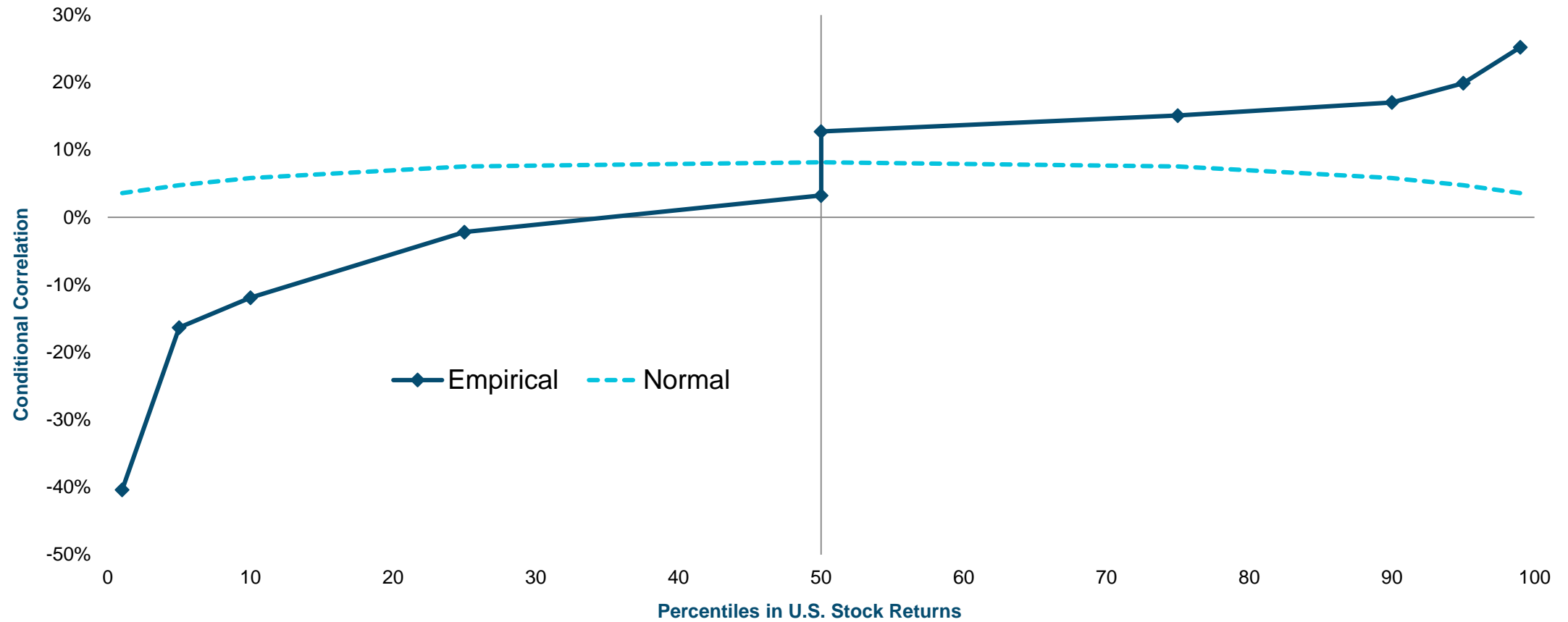


The value (security selection) and momentum (security selection) factors are long-short, rank-weighted models of US individual stocks. The cross-asset value and momentum factors allocated to equity indexes, currencies, rates, and commodities, also with a long-short, rank-weighted methodology. Left-tail and right-tail correlations are at the 1st and 99th percentiles but were adjusted by the data-augmentation methodology. For value and momentum, we used data from Asness, Moskowitz, and Pedersen (2013; data available at www.aqr.com). The size factor is from Fama and French (1993). All three currency factors are long-short, as calculated by Deutsche Bank. See Appendix on page 17 for risk assets and data sources.

True Sources of Diversification....

January 1973 through June 2017

CONDITIONAL CORRELATION PROFILE FOR US STOCKS VS. TREASURIES



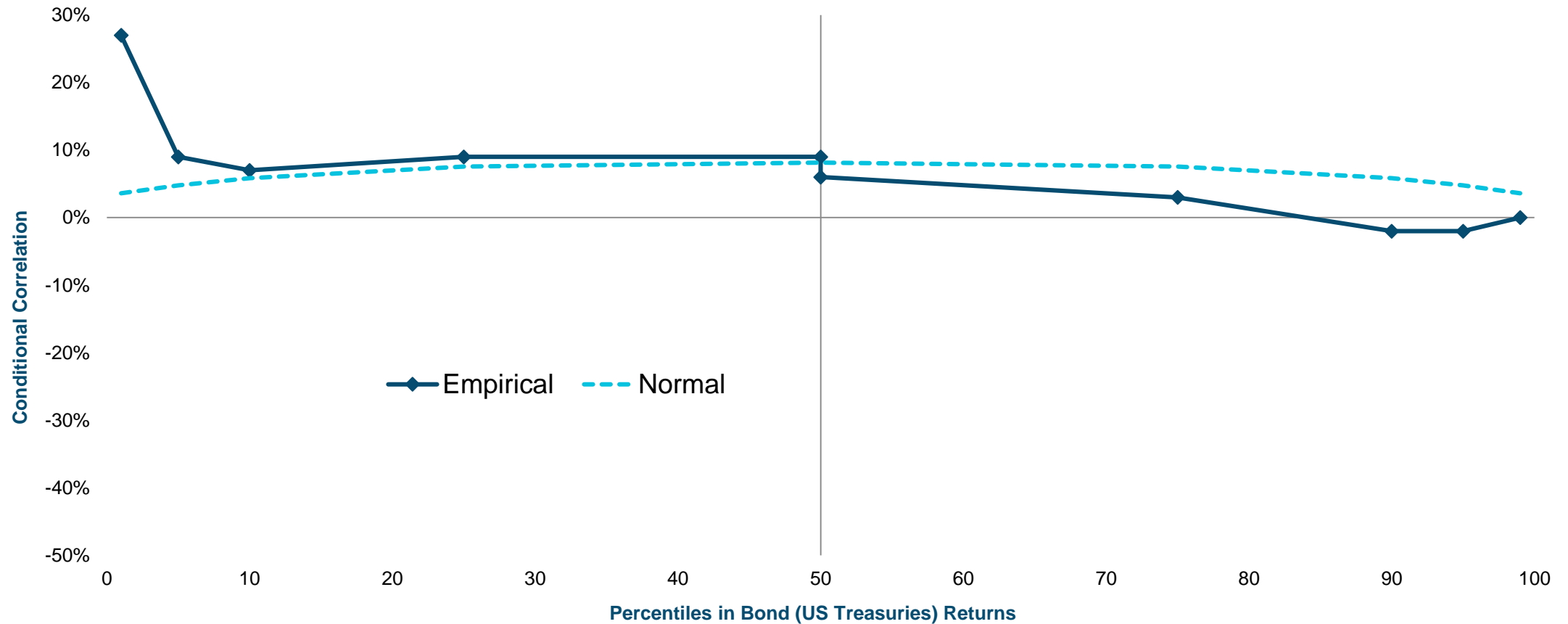
Monthly data.

For Treasuries, we used the Barclays Capital Long U.S. Treasury Index. Results were similar for the Barclays U.S. Treasury Bond and the Barclays Capital Intermediate U.S. Treasury Indexes (not reported). See Appendix on page 17 for risk assets and data sources.

But Not In All Environments

January 1973 through June 2017

CONDITIONAL CORRELATION PROFILE FOR TREASURIES VS. US STOCKS



Monthly data.

For Treasuries, we used the Barclays Capital Long U.S. Treasury Index. Results were similar for the Barclays U.S. Treasury Bond and the Barclays Capital Intermediate U.S. Treasury Indexes (not reported). See Appendix on page 17 for risk assets and data sources.

Why Does Diversification Seem To Disappear When We Need It The Most?

WHEN DIVERSIFICATION FAILS
Third Quarter 2018 Issue | Vol. 24, Number 3



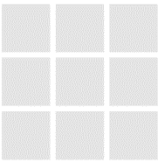
Sébastien Page, CFA
Robert A. Panariello, CFA



Recommendations - Analytics

- Do not blindly rely on full-sample correlations for portfolio construction
- Give scenario analysis a meaningful role in asset allocation decisions
- Consider the use of optimization tools that account directly for tail risks
- Beware of “diversification free lunches” in privately held asset classes
- Evaluate interest rate risk and its impact on stock-bond diversification
- Seek asset classes that provide upside “unification”/anti-diversification
- Estimate the end investors’ risk tolerance (against returns) accordingly

We’re not arguing against diversification. We’re arguing for better diversification.



Investment Solutions: Active Management

- Hedging with put options and proxies
- Strategies that embed short positions
- Defensive momentum factors/strategies
- Actively-managed absolute return alts
- Managed volatility overlays/strategies
- Cash?

Tail risk-aware analytics, as well as hedging and dynamic strategies, are now widely available to help investors manage the failure of diversification.

APPENDIX

Risk Assets/Data Sources

Risk Assets	Data Source
Stocks	
U.S. Stocks/Large Stocks	MSCI USA
Developed Markets Stocks	MSCI EAFE (Local)
Emerging Markets Stocks	MSCI EM (Local)
Growth Stocks	Russell 1000 Growth
Small Stocks	Russell 2000
Bonds (Excess Returns)	
Corporate Bonds	Barclays U.S. Corp.
MBS Bonds	Barclays U.S. MBS
High Yield Bonds	Barclays U.S. HY
Emerging Market Bonds	Barclays EMB
Alternatives	
Real Estate	NAREIT - All Equity
Hedge Funds	HFRI Gbl HFs

HF Style	Data Source
Macro	HFRX
Event Driven	HFRX
Equity Hedge	HFRX
Equity Market Neutral	HFRX
Merger Arbitrage	HFRX
Relative Value	HFRX
Relative Value Convert.	HFRX

Private Assets	Data Source
Real Estate	NCREIF Property
Private Equity	Cambridge Assoc.
Rolling Annual (4 Qs)	
Real Estate	NCREIF Property
Private Equity	Cambridge Assoc.

Risk Factors	Data Source
Value (Security Selection)	AQR
Momentum (S. Selection)	AQR
Size (Small minus Big)	Fama-French
Cross-Asset Value	AQR
Cross-Asset Momentum	AQR
Currency Carry	Deutsche Bank
Currency Momentum	Deutsche Bank
Currency Value	Deutsche Bank

Treasuries	Data Source
Stocks vs. Bonds	Barclays Long Treas.
Bonds vs. Stocks	Barclays Long Treas.

All data are monthly, with the exception of private assets, for which we use quarterly data.



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