



INNOVATIONS IN MULTI-ASSET INVESTING

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Head of Asset Allocation

August 2017



T. Rowe Price—Presenter



Portfolio Management

Sebastien Page, CFA

Head of Asset Allocation

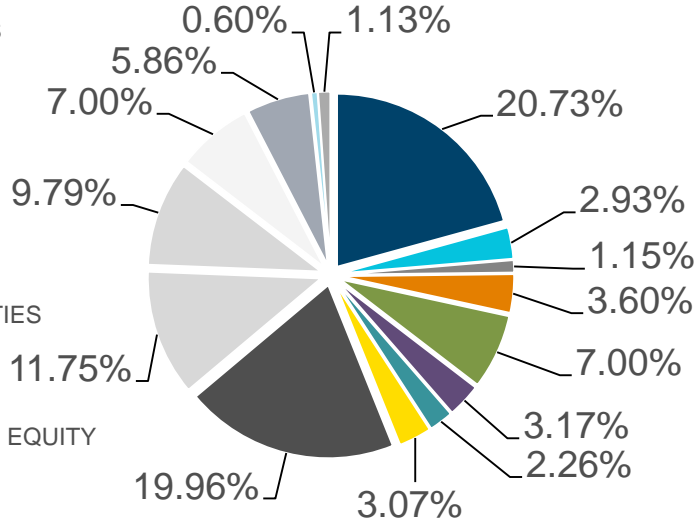
- 20 years of investment experience;
- 2 years with T. Rowe Price.

Risk Factors (50% Currency Hedge)

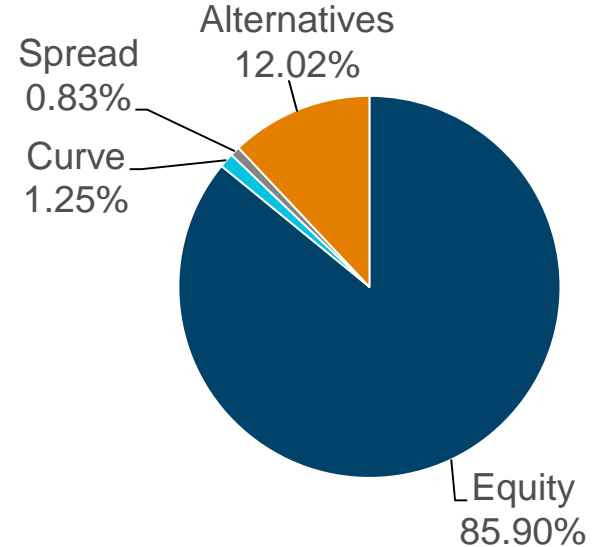
Figures are Calculated in CAD

ASSET ALLOCATION (%) FOR CAD PENSION RISK DECOMPOSITION

- CANADIAN NOMINAL BONDS
- REAL RETURN BONDS
- MORTGAGES
- FOREIGN FIXED INCOME
- CANADIAN EQUITIES
- U.S. EQUITIES
- EAFE EQUITIES
- EMERGING MARKETS EQUITIES
- GLOBAL EQUITIES
- REAL ESTATE
- VENTURE CAPITAL/PRIVATE EQUITY
- INFRASTRUCTURE
- OTHER ASSETS
- HEDGE FUNDS—used as part of portable alpha strategy
- HEDGE FUNDS—not used as part of portable alpha strategy



RISK DECOMPOSITION BY FACTOR



For illustrative purposes only.

Sources: Barra and T. Rowe Price.

Barra, Inc.'s analytics and data (www.barra.com) were used in the preparation of this report. Copyright 2017 BARRA, INC. All Rights Reserved.

Correlations of Risk Factors

As of 31 December 2015



Past performance is not a reliable indicator of future performance.

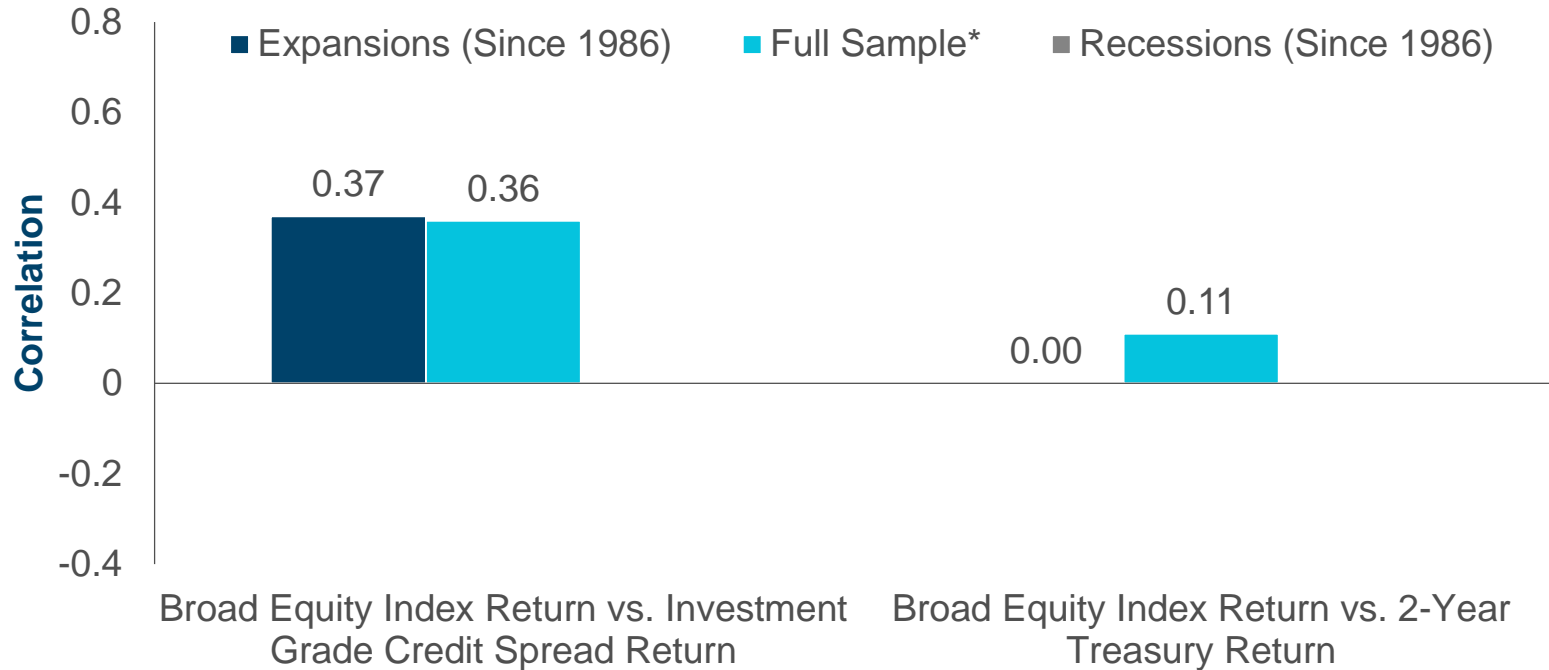
Original Source was book *Factor Investing and Asset Allocation* from Vasant Naik, Mukundan Devarajan, Andrew Nowobilski, Sébastien Page, CFA, and Niels Pedersen.

*Full sample correlations for U.S. investment-grade credit spread returns are from January 1973. Otherwise, correlations are from February 1955.

Data frequency is monthly. Sources: NBER and PIMCO.

Correlations of Risk Factors

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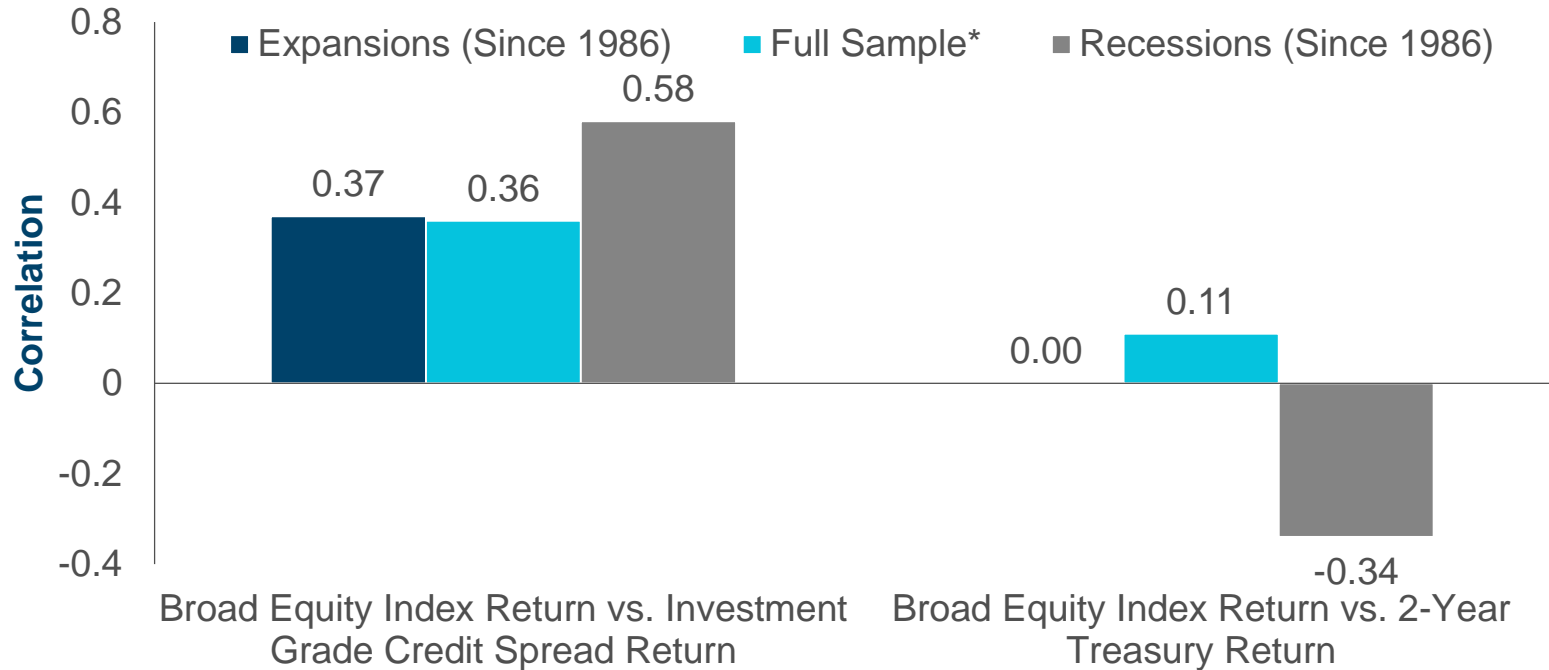
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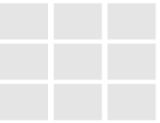


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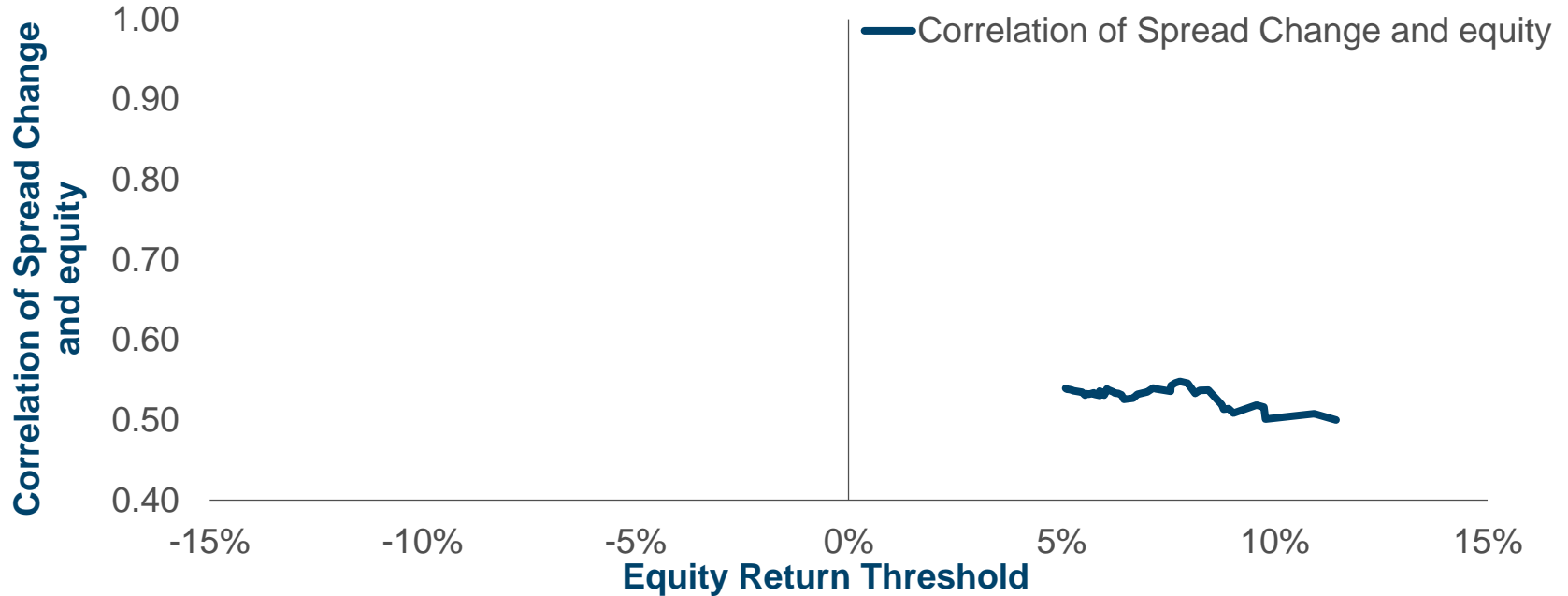
Data frequency is monthly. Sources: NBER and PIMCO.



The Myth of Diversification

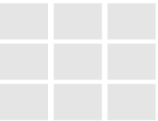
31 August 1989 Through 31 December 2016

CREDIT-EQUITY CONDITIONAL CORRELATIONS



Past performance is not a reliable indicator of future performance.

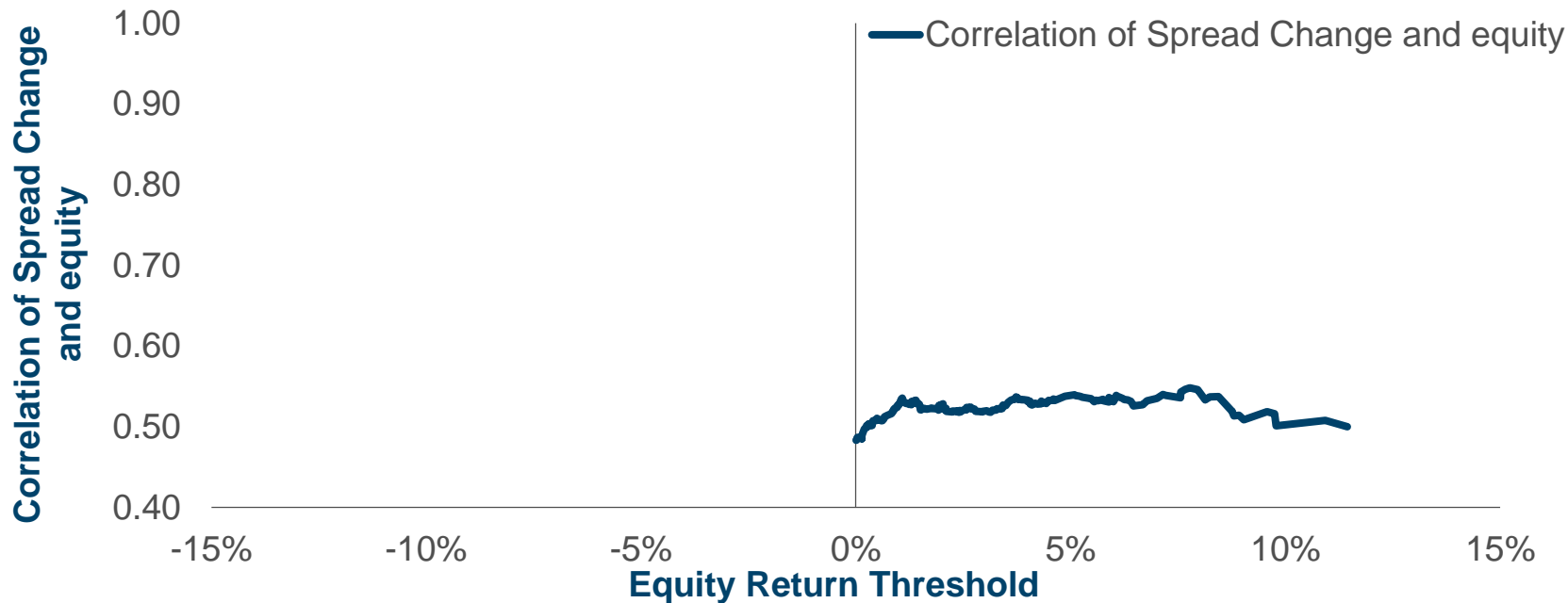
Sources: Bloomberg Barclays and T. Rowe Price.



The Myth of Diversification

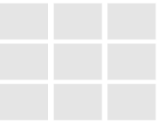
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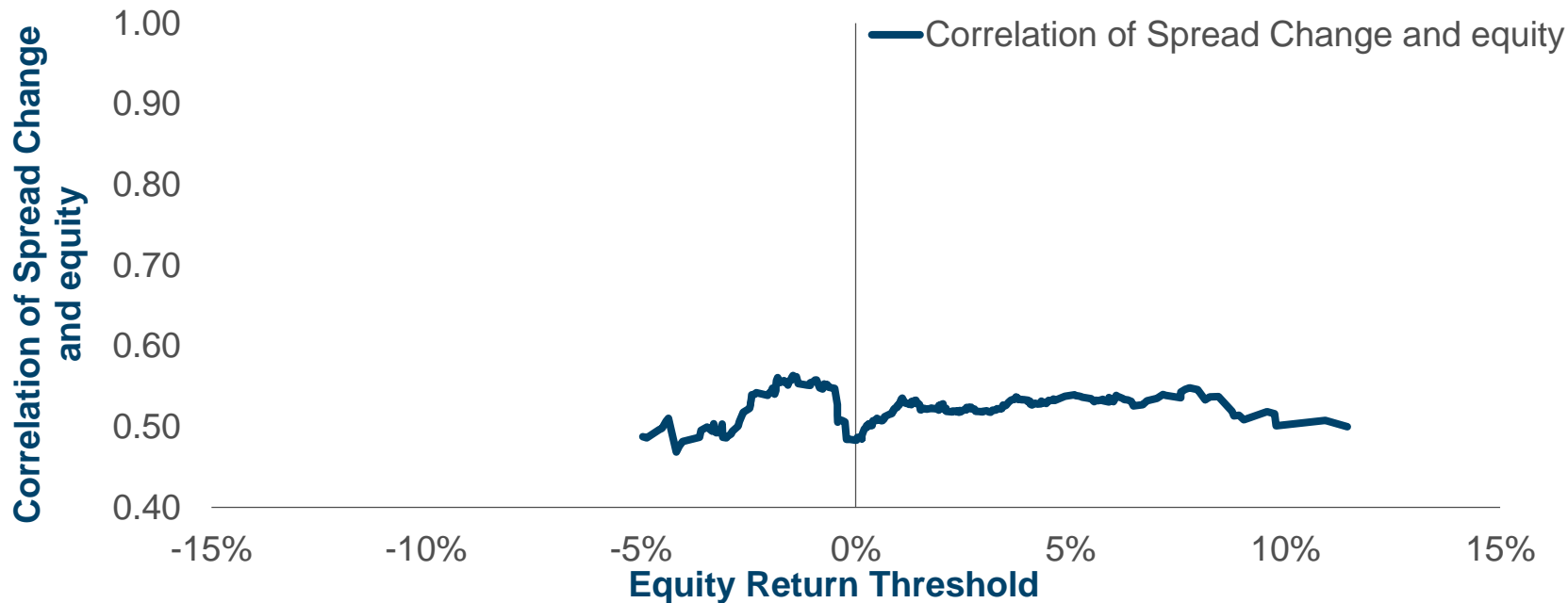
Sources: Bloomberg Barclays and T. Rowe Price.



The Myth of Diversification

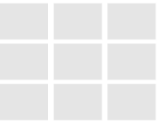
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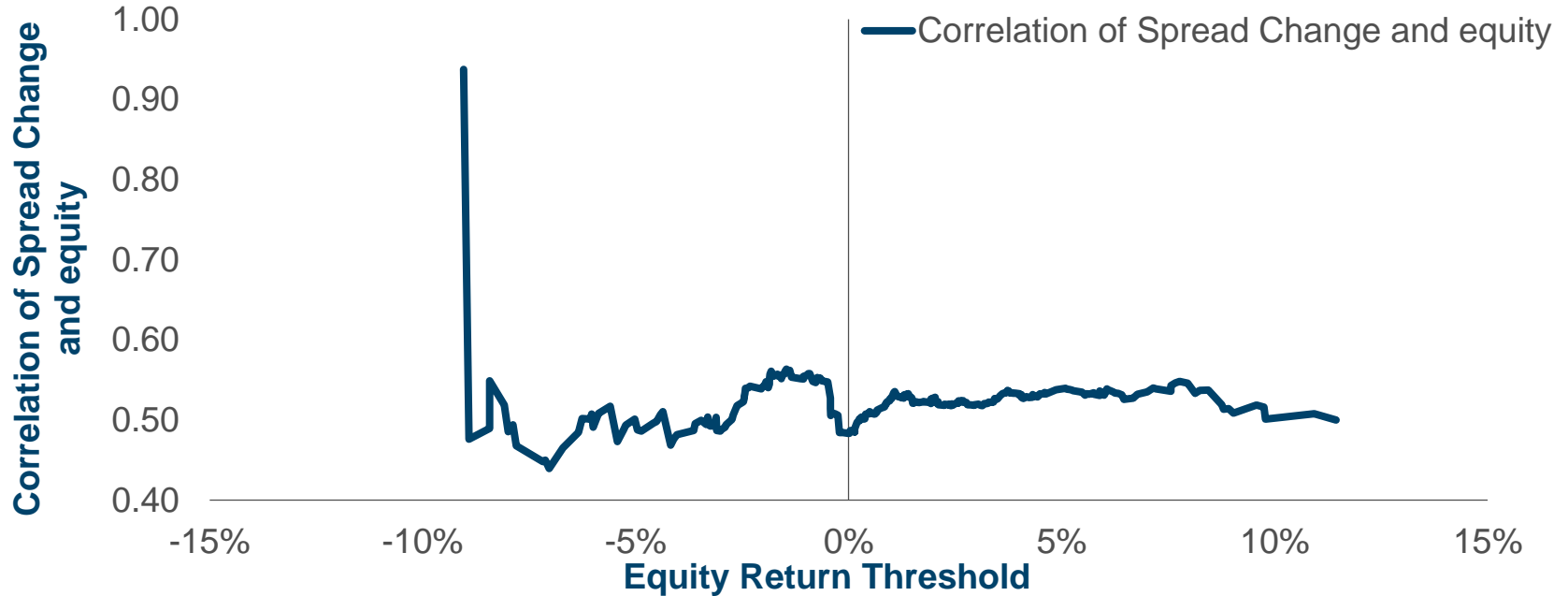
Sources: Bloomberg Barclays and T. Rowe Price.



The Myth of Diversification

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CREDIT-EQUITY CONDITIONAL CORRELATIONS



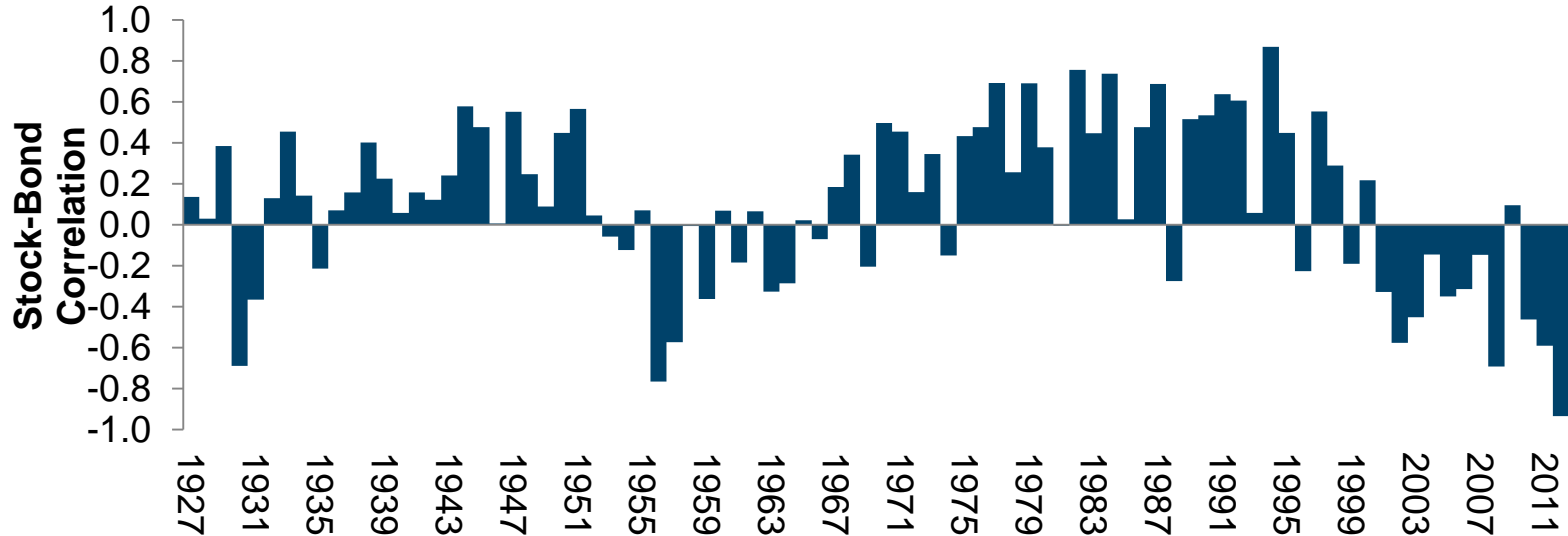
Past performance is not a reliable indicator of future performance.

Sources: Bloomberg Barclays and T. Rowe Price.

Stock-Bond Correlations

June 1927–December 2015

12-MONTH CORRELATIONS BETWEEN EXCESS RETURNS ON U.S. EQUITIES AND ON 20-YEAR U.S. TREASURIES



Past performance is not a reliable indicator of future performance.

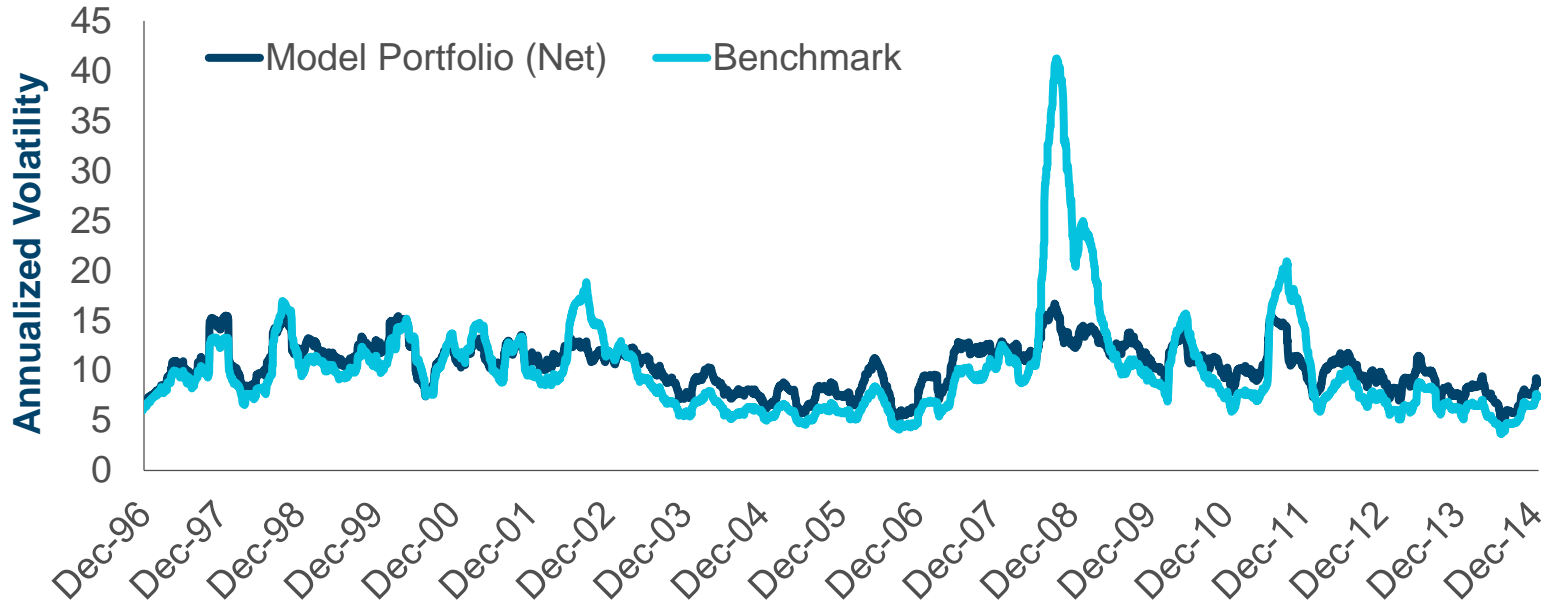
Sources: Bloomberg Barclays, data library of Kenneth French, Ibbotson Associates, and PIMCO.

See the appendix for important information.

Risk-Based Investing

December 1996–December 2014

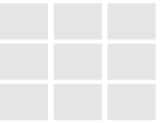
ROLLING 60-DAY VOLATILITY OF MANAGED VOLATILITY PORTFOLIO VS. STATIC BENCHMARK



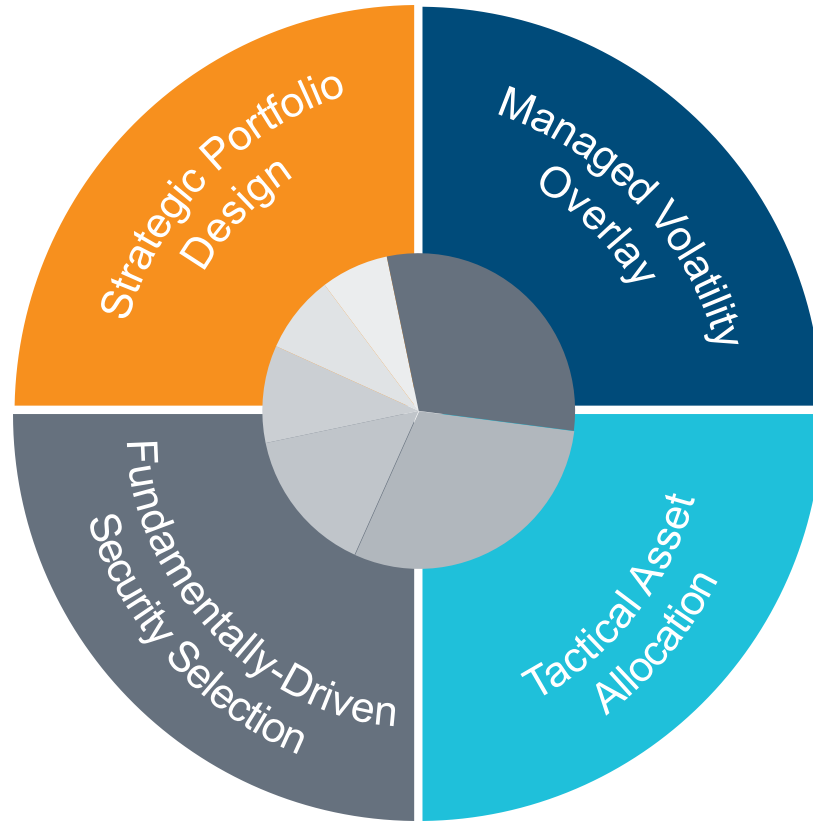
Past performance is not a reliable indicator of future performance.

Sources: Standard & Poor's, MSCI, Bloomberg Barclays, and T. Rowe Price.

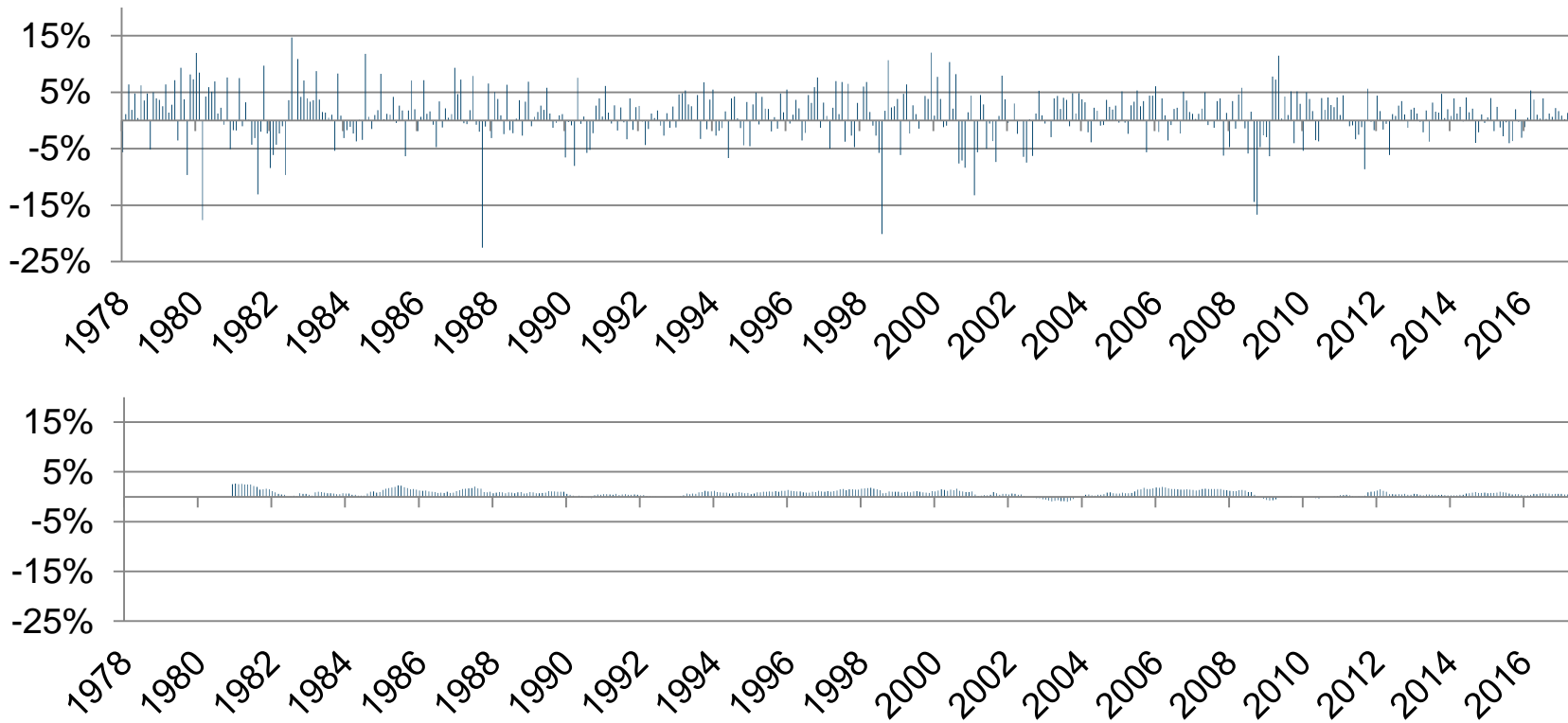
See the appendix for important information.



Managed Volatility in Active Balanced



Which Asset Class Would You Choose?



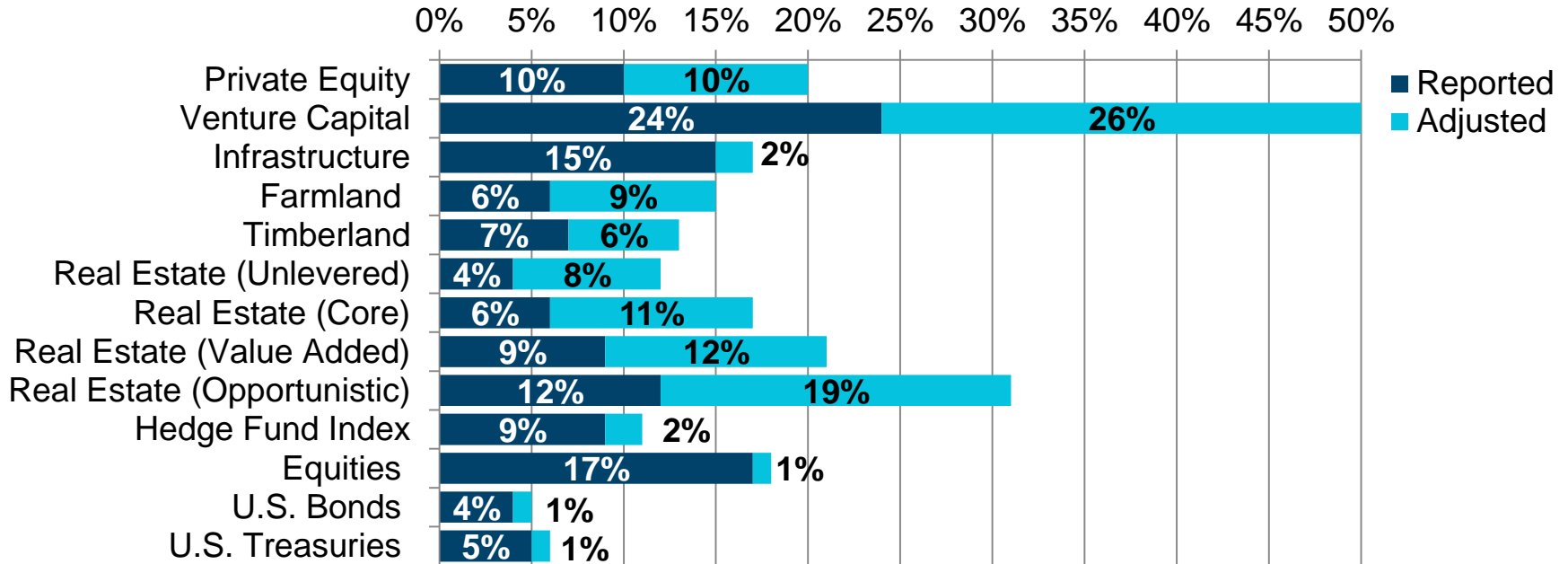
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Sources: T. Rowe Price and Standard & Poor's.

Risk Models for Alternative Investments

December 1992–December 2015

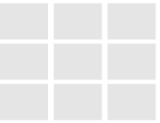
VOLATILITIES: REPORTED VS. ADJUSTED¹



¹ The values reported show the contributions from systematic (factor) and idiosyncratic volatilities to the total adjusted volatility.

Sources: Bloomberg, Cambridge Associates, Kenneth French's website, National Council of Real Estate Investment Fiduciaries (NCREIF), and PIMCO.

See the appendix for important information.



Takeaways

- It's crucial to put risk at the center of investment decisions
- Factor analysis often reveals a lack of true diversification
- Diversification may disappear when we need it the most
- Even the stock-bond correlation can be highly unstable
- Managed volatility strategies may help alleviate the issues
- Private assets may be riskier than implied by valuation data

Bottom line: improved risk models and risk-based investing strategies may provide opportunities for Canadian investors to improve investment outcomes.



APPENDIX



Disclosures

Slide 11: Original Source was book *Factor Investing and Asset Allocation* from Vasant Naik, Mukundan Devarajan, Andrew Nowobilski, Sébastien Page, CFA, and Niels Pedersen. U.S. equity returns are monthly and taken to be those of the market factor from the data library of Kenneth French until December 1954. After this date, the equity returns are as described in the Appendix (item A.3.2). Returns to 20-year Treasuries use data from Ibbotson Associates for returns and yields on long-term (20-year) US Treasury bonds until 1981. From 1982 on, Treasury returns are as described in the Appendix (A.3.2). For the period 1927–1954, excess returns are over returns to 3-month Treasury bills. From 1955 on, excess returns are computed as described in the Appendix (A.3.2).

A.3.2. Data Sources for Exhibits—For the period 1955–1969, the return on a broad US equity index is taken to be that of the market factor from the data library of Kenneth French. For the period 1970–1987, returns on U.S. equities correspond to those of the MSCI USA Index. After 1988, returns on U.S. equities are the returns to the S&P 500. The longbond yield from Ibbotson Associates is used for Treasury yields for securities 20 years to maturity until 1981. Thereafter, par rates provided by Gurkaynak, Sack, and Wright (2006) are used until 1996. After 1996, the 2-year, 5-year, 10-year, and 20-year Treasury return series are spliced with returns to the Bloomberg Barclays U.S. Treasury 1–3 Years Index, the Bloomberg Barclays U.S. Treasury 3–5 Years Index, the Bloomberg Barclays U.S. Treasury 7–10 Years Index, and the Bloomberg Barclays U.S. Long Treasury Index, respectively. Excess returns to Treasuries and equities prior to 1988 are computed using the effective federal funds rate. For the period 1988–2001, excess returns are computed relative to 1-month LIBOR less 5 bps, to adjust for the average credit spread embedded in LIBOR. From 2002 on, excess returns are computed versus the 1-month overnight index swap (OIS) rate.

Slide 12: Original Source was article Return of the Quants: Risk-Based Investing from Anna Dreyer, CFA, Robert L. Harlow, CFA, Stefan Hubrich, CFA, and Sébastien Page, CFA. Note: The managed volatility benchmark is composed of 65% equity (45.5% S&P 500 Index and 19.5% MSCI EAFE Index) and 35% fixed income (Bloomberg Barclays U.S. Aggregate Bond Index).

Managed Volatility Model Portfolio—The Managed Volatility Model Portfolio is a back-tested model designed to illustrate a hypothetical managed volatility strategy. The model portfolio uses an 11% volatility target for a balanced portfolio of 65% stocks and 35% bonds. The managed volatility overlay allows the equity exposure to range from 20% to 75%. The results of this model are hypothetical, do not reflect actual investment results, and are not a guarantee of future results. Hypothetical results were developed with the benefit of hindsight and have inherent limitations. Hypothetical results do not reflect actual trading or the effect of material economic and market factors on the decision-making process. Results of the model portfolio reflect deduction of highest applicable fee schedule without benefit of breakpoints; the management volatility overlay results do not include transaction costs. Results have been adjusted to reflect the reinvestment of dividend and capital gains. Actual returns may differ significantly from the results shown above.



Disclosures (cont.)

Slide 15: Data period is from December 1992 through December 2015. The models for Private Equity and Venture Capital are based on data from December 2001 to December 2015 and December 1996 to December 2015, respectively, whereas the infrastructure model is based on data since September 2000 due to data availability. The analysis is based on quarterly data, except for Timberland and Farmland where we use annual data frequency.

Indices used for different asset classes and their underlying risk factors are as follows. Private Equity: Cambridge Associates U.S. Private Equity Index. Venture Capital: Cambridge Associates U.S. Venture Capital Index. Infrastructure: Macquarie Global Infrastructure Index. Farmland: NCREIF Farmland Property Index. Timberland: NCREIF Timberland Property Index. Real Estate: NCREIF Property Index, NCREIF Open-ended Core Diversified Equity Index, NCREIF-Townsend Value Added Funds Index, and NCREIF-Townsend Opportunistic Funds Index. Hedge Funds: Credit Suisse Hedge Fund Index. U.S. Equity market, size and value factors: Kenneth French Website. U.S. Bonds: Bloomberg Barclays U.S. Aggregate Index. U.S. Government Bonds: Bloomberg Barclays U.S. Treasury index.

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