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Advanced Diversification: A Primer

Overview

Investors spend an inordinate amount of time and effort seeking investments that offset, or otherwise "hedge" risky assets, yet modern portfolio theory has proven this is a suboptimal approach that provides only a small portion (less than 10% in our analysis below) of diversification's benefits. In this paper we use modern portfolio theory to deconstruct the three elements of diversification to quantify the benefits of each of the segments and indicate how to apply them to building a more efficient portfolio. In this paper we review and explain the three main sources of diversification's benefits, which are:

1. **Buffering Effect:** Benefits of Low Volatility
2. **Decorrelation Effect:** Benefits of Low Correlation
3. **Hedging Effect:** Benefits of Negative Correlation

We demonstrate, through quantitatively deconstructing diversification using modern portfolio theory analysis, that the vast majority (90%+) of the benefit comes from the Buffering Effect and the Decorrelation Effect.

We then review an advanced diversification approach which focuses on low volatility and low correlation assets to diversify a portfolio more effectively.

Portfolio Composition and Volatility

We start with the concrete and well-known example of a 60%/40% portfolio, with the S&P 500 as the equity portion (60%), and 10-year US Treasury Note ("UST10Y") as the fixed income portion (40%). We then utilize a mean-variance analysis framework to calculate volatility over the twenty-year period from January 2001 to December 2020.

The mean-variance analysis demonstrates that adding 40% of UST10Y to a portfolio consisting of only 100% equity as represented by the S&P 500 would have reduced overall portfolio volatility from 23.8% to 13.6% annually - a very significant annual benefit of 10.2 percentage points in volatility reduction.

FIGURE 1 | **Allocating 40% to 10-year US Treasuries from a 100% equity portfolio would have reduced portfolio volatility by over 10.2 percentage points per annum.**

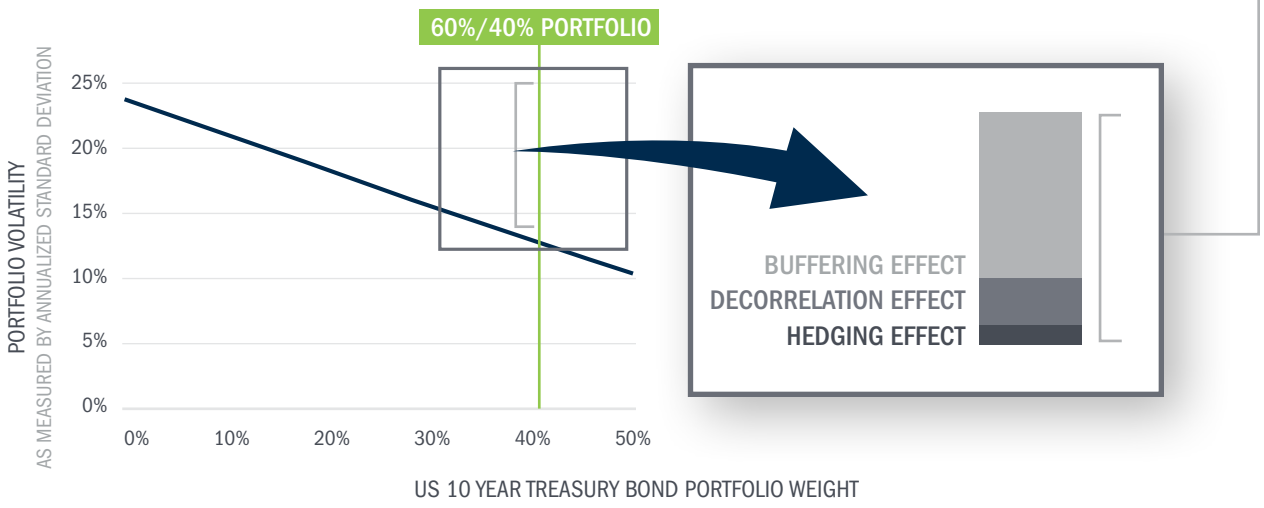


Chart data 01.01.2001-12.31.2020

Deconstructing Diversification – 90% of Benefits from Low Volatility and Low Correlation

We utilize the same mean-variance analysis (see Appendix for details) to deconstruct the components of diversification's benefits by performing three separate calculations - in each case changing only one variable to isolate its impact. We derive the following conclusions:

1. **Buffering Effect** - We assume that the S&P500 and UST10Y have a perfect 1.0 correlation, allowing us to isolate the benefit of low volatility. Mean Variance analysis indicates that fixed income (or more broadly a low volatility investment) provides an incredible 71% of diversification's benefit.
2. **Decorrelation Effect** – We assume that the S&P500 and UST10Y have a 0.0 correlation, allowing us to isolate the benefit of non-correlation. Mean Variance analysis indicates that a non-correlated investment provides 21% of diversification's benefit.
3. **Hedging Effect** – We utilize the historical correlation of S&P500 and UST10Y of -0.4, allowing us to isolate the benefit of negative correlation. Mean Variance analysis indicates that a negatively correlated investment such as fixed income provides 8% of diversification's benefit.

Detailed Analysis

Buffering Effect - Low Volatility Generates 71% Of Diversification's Benefits.

We apply mean-variance analysis to calculate the benefits of low volatility. To isolate low volatility's benefits, we assume that equities (S&P500) and fixed income (UST10Y) have a correlation value of 1.0 (i.e. fully correlated) to eliminate any low/negative correlation benefits. The analysis demonstrates that adding a 40% allocation of UST10Y (volatility: 5.7%) reduces total portfolio volatility by an annualized 7.3% points - or an incredible 71% of the previously noted total benefit of diversification.

Decorrelation Effect – Low Correlation Generates an Additional 21% In Diversification Benefits.

Next, we apply mean-variance analysis to calculate the benefits of a lack of correlation. To isolate the benefits, we assume that equities (S&P500) and fixed income (UST10Y) have a 0.0 correlation, and again measure any incremental difference in volatility reduction. The analysis demonstrates that adding a 40% allocation of UST10Y reduces total portfolio volatility by an additional 210 basis points annualized - or a 21% additional benefit from diversification which is totally attributable to lack of correlation.

Hedging Effect – Negative Correlation generates an additional 8% in Diversification's Benefits.

Next, we apply mean-variance analysis to calculate the benefits of negative correlation. To isolate the benefits, we apply mean-variance analysis to equities (S&P500) and fixed income (UST10Y) at their -0.4 historical correlation, and again measure any incremental difference in volatility reduction. The analysis demonstrates that adding a 40% allocation of UST10Y reduces total portfolio volatility by an additional 85 basis points, or less than one-tenth of the original total reduction.

Thus, we can conclude through this exercise that negative correlation, or the Hedging Effect is by far the smallest benefit from diversification. Low volatility and low correlation components contribute much more significantly to reducing a portfolio's total volatility.

Yet investors spend an inordinate amount of time and effort seeking investments that offset, or otherwise "hedge" risky assets which provide less than 10% of diversification's benefits. We believe that investors should instead focus on seeking assets that demonstrate low volatility which generates over 70% of the benefit and low correlation, which together provide over 90% of diversification's benefits.

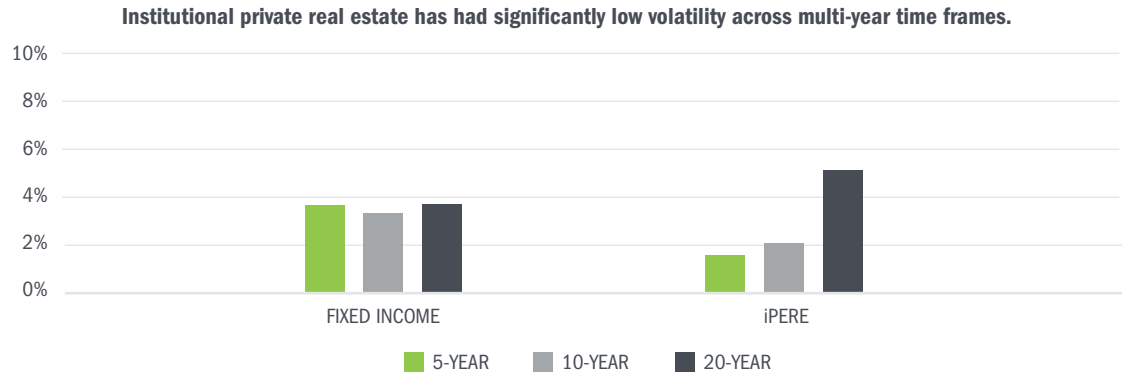
Advanced Diversification In Practice - Institutional Private Real Estate

We have established that the most significant benefits of diversification derive from low volatility and low correlation. As an asset class, institutional private equity real estate (iPERE) has exhibited both features.

Volatility

On the volatility front, iPERE has historically exhibited significantly low volatility across multi-year time frames, which lays the foundation for institutional real estate as an effective diversifier. Figure 2 below shows the volatility for iPERE as well as for fixed income as a comparison between diversifiers.

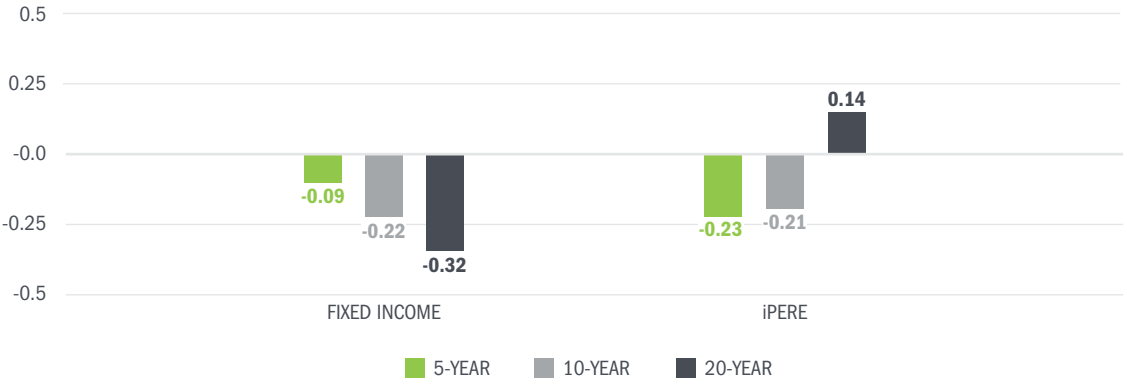
FIGURE 2 | **Annualized Volatility of Various Asset Classes**



Correlation

Conversely, on the correlation side, institutional private real estate has also shown compelling statistics. Not only has the correlation been low between private real estate and equities for the trailing twenty years, but in more recent trailing periods it has also been slightly negative and comparable to fixed income. Thus private real estate has offered the Decorrelation Effect in the long-term, and both Decorrelation and Hedging Effects in the short-term.

FIGURE 3 | **Long-Term Correlation Values Between Equities and Major Diversifying Asset Classes**



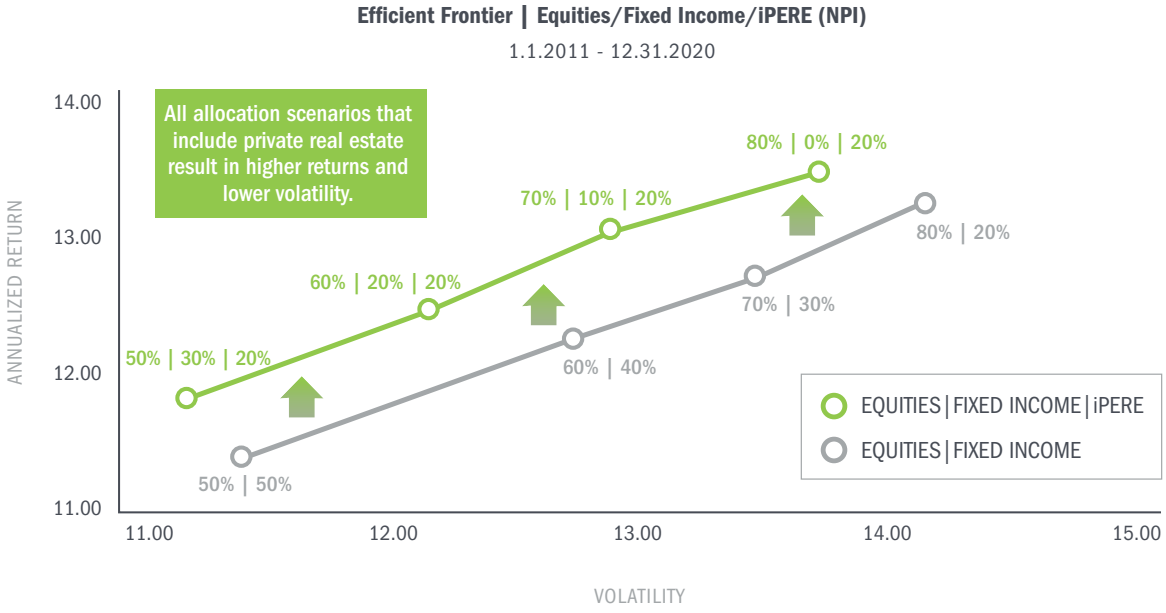
Correlation: the degree to which two securities move in relation to each other. Correlation is measured as a correlation coefficient, with a with a value falling between -1 and 1. 0 = No Correlation | 1 = Perfectly Positively Correlated | -1 = Perfectly Negatively Correlated. Bonds - The Barclays U.S. Aggregate Bond Index: measures the performance of the U.S. investment grade bond market. Stocks - S&P 500: An index of 500 stocks chosen for market size, liquidity and industry grouping, among other factors.

Advanced Diversification Generates More Efficient Portfolios

If we use iPERE's track record to make an allocation decision, the low volatility and low correlation characteristics of institutional private real estate manifest themselves as we would expect: a highly efficient portfolio diversifier.

Figure 4 shows this graphically: the gray line represents a portfolio of equities and fixed income at various allocation sizes, from 50/50 up to 80/20, and the resulting various degrees of returns and volatility. The green line represents portfolios with equity, fixed income, and also a 20% allocation to private real estate. In every allocation scenario that included private real estate, the volatility was lower and returns were higher than the comparable equity/fixed income only portfolio.

FIGURE 4 | **New Allocation Approach: An Improvement to the Established Example**



This real-world example reiterates that assets with both low-volatility and low-correlation characteristics are highly effective at diversifying portfolios, and investors need not seek out potential opportunities that offer a hedging effect.

We invite you to reach out to your *Bluerock representative* for a further conversation about this strategy, or to connect you with our portfolio management team to discuss this paper.

Appendix

Modern Portfolio Theory (MPT)

Using mean-variance analysis to calculate a portfolio's expected risk.

MPT, otherwise known as mean-variance analysis is a mathematical framework to estimate risk and return for a group of assets. It is a quantification of diversification, which states that owning multiple assets is less risky than owning only a single asset. In MPT, variance is used as the metric for risk. Variance is directly related to standard deviation, which is also a widely used industry metric for risk.

In MPT, three inputs are used to calculate a portfolio's total risk (variance).

1. The standard deviation of individual assets within the portfolio
2. The correlation between individual assets
3. The allocation weight to each individual asset

For a given portfolio with two assets, total portfolio volatility using mean-variance analysis is calculated by:

$$\sigma_p^2 = w_A^2 \sigma_A^2 + w_B^2 \sigma_B^2 + 2 w_A w_B \sigma_A \sigma_B \rho_{AB}$$

Where:

- Portfolio return volatility is the standard deviation of returns and the square root of variance, and is represented by: $\sigma_p = \sqrt{\sigma_p^2}$
- Standalone volatility of Assets A and B, respectively, are represented by: σ_A and σ_B
- Allocation weights to Assets A and B, respectively, are represented by: w_A and w_B and where $w_A + w_B = 1$
- Correlation between Assets A and B is represented by: ρ_{AB} and where $-1 \geq \rho_{AB} \leq 1$

Baseline Scenario

To calculate the portfolio volatility graph in Figure 1 and dark blue line in Appendix A, historical values are used for σ_A, σ_B, and ρ_{AB} for equities and fixed income, respectively. Allocation weights w_A and w_B are changed from 0→1 and 1→0 on a linear basis, with the sum equal to 1.0.

Buffering, Decorrelation, and Hedging Effect Analyses

To calculate the Buffering Effect, the value for ρ_{AB} is changed to 1.0 to assume perfect correlation and to create diversification solely from the low volatility component, resulting in the dashed light blue line in Appendix A. The difference between the portfolio volatility of the Baseline Scenario is compared to the new calculated portfolio volatility.

To calculate the Decorrelation Effect, the value for ρ_{AB} is again changed to 0.0 to assume no correlation between assets A and B, resulting in the dotted grey line in Appendix A. The difference in portfolio volatility calculated with the Buffering Effect (correlation = 1.0) is compared to that with the Decorrelation Effect (correlation = 0.0).

Lastly, to calculate the Hedging Effect, the difference in portfolio volatility between the Baseline Scenario (with ρ_{AB} = -0.4 historical correlation) and the ρ_{AB} = 0.0 scenario of the Decorrelation effect is compared.

Definitions

Modern portfolio theory (MPT), or mean-variance analysis, is a mathematical framework for assembling a portfolio of assets such that the expected return is maximized for a given level of risk. It is a formalization and extension of diversification in investing, Economist Harry Markowitz introduced MPT in a 1952 essay, for which he was later awarded a Nobel Prize in Economics. *Source: Investopedia*

Pearson's Correlation Coefficient *is the test statistics that measures the statistical relationship, or association, between two continuous variables. It is known as the best method of measuring the association between variables of interest because it is based on the method of covariance. It gives information about the magnitude of the association, or correlation, as well as the direction of the relationship.*

Risk-off environment is an investment setting in which price behavior responds to and is driven by changes in investor risk tolerance in response to global economic patterns. When risk is perceived to be high, investors have the tendency to gravitate toward lower-risk investments. *Source: Investopedia*

Sharpe Ratio is a measure of the return of an investment based on the level of risk (volatility). A higher number indicating a higher return per unit of risk.

About Bluerock

Bluerock is a leading institutional alternative asset manager based in New York with regional offices across the U.S. Bluerock principals have a collective 100+ years of investing experience, have been involved with acquiring over 50 million square feet of commercial and residential real estate with approximately $13 billion in value, and have helped launch multiple leading real estate private and public company platforms. Bluerock's experience includes more than $8 billion of owned, managed, and sponsored assets and offers a complementary suite of public and private investment programs, with both short and long-term goals, to individual investors seeking solutions aimed at providing predictable income, capital growth, and tax benefits.

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