A Contemporary View of Portfolio Risk and Diversification

by Edward Patchett and Jonathan Horgan
When investing employee benefit plan assets, fiduciaries seek to limit portfolio risk through diversification by investing in many asset classes. However, this traditional approach to diversification has some significant limitations. Investors should be aware of the major risk factors embedded in traditionally defined asset classes and recognize that different asset classes can share common underlying risk factors. The result: Portfolios may not be as diversified as intended.

In this article, we summarize how portfolio risk is traditionally viewed and evaluated. We point out some caveats and limitations to the traditional approach of diversification. Finally, we highlight key considerations for achieving better diversification.

Traditional View of Portfolio Risk

Because risks are perceived differently, a universal definition of investment portfolio risk remains elusive. Traditionally, risk is defined as the uncertainty of an adverse outcome, where greater uncertainty implies greater risk.

In finance, risk is frequently defined by a statistical measure known as variance. A larger variance means there is more dispersion of returns around the average historical or expected return, which implies greater uncertainty—and greater risk. Standard deviation is a statistical measure often used to express the risk of an asset class and in a total portfolio. For example, stocks are inherently more risky than bonds (their returns are much less predictable). Therefore, stocks have a higher standard deviation of returns than bonds. So a portfolio with a high allocation to stocks will have a higher standard deviation of returns than a portfolio with a high allocation to bonds.1

Harry Markowitz developed the concept of quantifying risk in terms of variance in his influential paper “Portfolio Selection,” published in 1952. Prior to this, there was no consensus about risk within the investment community. Markowitz developed a basic portfolio model that quantified risk in terms of variance. More importantly, in the process he demonstrated that investors could reduce the variance of a total portfolio’s returns by combining different assets whose individual returns do not move in perfect tandem (they exhibit less-than-perfect positive correlation). For example, the returns on stocks and bonds tend not to move up and down at the same time and by the same amount (they have low correlation). By mixing the two assets together, it’s possible to create a portfolio that maximizes returns through time while minimizing risk.

Markowitz formalized the concept of diversification and gave rise to modern portfolio theory (MPT). As a result, the standard deviation of a portfolio’s returns became the accepted measure of portfolio risk. A lower standard deviation implied less dispersion or returns around the historical or expected return and, implicitly, less uncertainty/risk.

Asset allocation is the process of investing capital across a variety of assets in order to minimize risk for a given level of expected return. It derives from MPT. Traditionally, asset allocation modeling involves a process known as mean variance optimization. The modeling process requires inputting expectations for three key variables (1) the expected risk (i.e., standard deviation) of each asset class; (2) the expected return for each asset class; and (3) the expected correlation for each asset class pair.

The mean variance optimizer uses these assumptions to generate the model’s output, also known as the efficient frontier, which is a set of portfolios (i.e., different combinations of asset classes) that is expected to produce the maximum rate of return for a given level of risk.

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Investment committees and boards of trustees typically use this analysis to guide their asset allocation decision making. They hope to increase the probability of achieving their investment objective while simultaneously reducing the uncertainty/risk associated with long-term investing.

Often, more than one efficient frontier will be presented to illustrate the benefits of additional diversification that might be achieved through a broader asset allocation. In other words, one efficient frontier will exist if the investor’s opportunity set is limited to stocks and bonds. Another (more) efficient frontier will exist if additional asset classes like non-U.S. stocks and real estate are included. A sample efficient frontier is shown in Figure 1.

While diversification remains a key principle to investing, trustees and plan fiduciaries should recognize that its application within the mean variance portfolio model has some practical limitations.

First, the optimizer is highly sensitive to the three inputs: expected return, expected risk and expected correlation. This sensitivity can often lead to imbalanced portfolios, necessitating the use of subjective constraints (i.e., where the individual running the model must subjectively apply maximum weights on a given asset class within the model) in order to stabilize the output and balance the portfolio. For example, real estate tends to produce returns over time that are less volatile (e.g., less risky) than stocks and higher returns than bonds with a modest level of correlation to those asset classes. Therefore, the computer optimizer will naively “overallocate” assets to real estate beyond a level that most investors would think is appropriate for a diversified portfolio.

Second, the model optimizer assumes that the three inputs are known with certainty. In fact, they are estimates developed by the individual or firm running the model and are subject to a high degree of estimation error (being wrong by a wide margin).

Third, the model assumes that asset class returns are normally distributed. For example, consider an asset allocation

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**FIGURE 1 >>**

Efficient Frontier Analysis

![Efficient Frontier Graph](image)

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FIGURE 2 >>

**Capital Allocation**

- **U.S. Equity**: 35%
- **Non-U.S. Equity**: 25%
- **Real Estate**: 5%
- **Core Fixed Income**: 20%
- **High Yield**: 5%
- **Hedge Funds**: 10%

**Risk Allocation**

- **U.S. Equity**: 49%
- **Non-U.S. Equity**: 37%
- **Real Estate**: 2%
- **Core Fixed Income**: 4%
- **Hedge Funds**: 5%
- **High Yield**: 3%

portfolio risk and diversification

FIGURE 3 >>

**Equity Risk Premium (Annual in %, 1926-2009, low to high)**

- **Average**: 7.9%
- **2008**: -39%
- **2008**: +26%

FIGURE 4 >>

**Asset Class Performance Comparisons**

- **Government Bonds**: -2.20%
- **High-Yield Bonds**: -26.20%
- **Stocks**: -37.00%

- **2008**: 12.40%
- **2009**: 58.10%
- **2008**: 26.50%
model that assumes bonds will produce an average return over time of 5% with a 5% level of risk (annualized standard deviation). Statistically speaking, a normal distribution assumes that bonds will produce average returns of 5% with a range of returns of +/-5% around that average approximately 68% of the time (e.g., one standard deviation of returns around the average). Thus, the model assumes the range around the average return is equally likely to be +5% over the average as it is to be -5% below the average (returns are distributed normally around the average). In reality, many asset classes demonstrate returns that are not normally distributed, but “skewed,” which implies an asymmetric return distribution—usually large negative events. Further, the model does not consider other types of risk (like illiquidity).

Lastly, correlations—or the degree to which asset class returns move in tandem—change through time, given changing market conditions. That can lead to higher realized risk than the model expected.

As a response to some of these limitations—many of which were highlighted during the market crisis of 2008—the investment community has embraced additional portfolio risk measures and risk mitigation tools, attempting to enhance overall risk awareness and rely less on single-point estimates and quantitative models.

**Contemporary View of Portfolio Risk**

Most defined benefit pension plans have a relatively long-term investment horizon, as liabilities extend well into the future. In our experience, such plans normally maintain a return objective of between 7% and 8%. Given this relatively high return objective (particularly in today’s low-interest rate environment), most long-term institutional portfolios have a bias toward asset classes that are expected to achieve a high real growth rate above inflation. This bias toward growth assets results in a relatively narrow opportunity set comprised of riskier asset classes that are expected to achieve a higher longer term return over time given their higher risk. In other words, investors expect they will earn a risk premium (or return in excess of a risk-free rate like U.S. Treasury bills) for accepting the uncertainty of “risky” asset class returns.

Given the typical return objective, most defined benefit pension plans allocate a significant portion of their investment portfolios to equity investments. That is illustrated in the capital allocation pie chart of Figure 2, where 60% of the capital in this sample portfolio has been allocated to equity investments (diversified to include 35% U.S. equity and 25% non-U.S. equity).

Nevertheless, allocating 60% of capital to one or more asset classes is not equivalent to allocating 60% of the portfolio risk. As illustrated in the risk allocation pie chart of Figure 2, despite representing 60% of the capital in this sample portfolio, equities represent a disproportionate 86% of the overall risk, effectively dominating the risk inherent within the portfolio.

Given this imbalanced risk allocation, the returns of this sample portfolio (both positive and negative) largely will be a function of the highly variable equity risk premium. Most recently, the realized equity risk premium was -39% in 2008 and +26% in 2009 (Figure 3), deviating significantly from the long-term average of 7.9%. Thus, by allocating a majority of their capital (and risk) to equities, many investors unintentionally sacrifice diversification in their pursuit of higher returns.

**Asset Classes vs. Exposure to Risk Factors?**

Returns for asset class (like stocks and bonds) are driven by their exposure to and the behavior of various risk factors.

Returns in bonds are driven primarily by their exposure to two risk factors—inflation risk and credit risk (the risk of default by the bond issuer). The more interest rate risk or credit risk a bond portfolio has, the more its performance will be driven by changes in investor risk aversion to these specific risk factors.

Put differently, when investors are less willing to accept specific risks, asset classes that carry those risk factors will...
generate negative returns. Conversely, when investors are more willing to accept specific risks, asset classes that carry those risk factors will generate positive returns.

For example, calendar year 2008 was characterized by an extreme “flight to quality.” Investors were exceptionally risk-averse, fearing a global economic depression. As a result, they avoided common risk factors like equity risk and credit risk, instead favoring the certainty of government bonds. Calendar year 2009 was marked by a gradual easing of this extreme risk aversion. Investors once again embraced credit risk and equity risk, and the asset classes dominated by those risk factors outperformed government bonds by a wide margin (Figure 4).

Given the link between risk factors and asset class returns, an investment portfolio can be thought of as simply a collection of various risk factors embedded within a number of different asset classes. However, it is very important to understand that certain risk factors can be magnified, as they are found within multiple asset classes. Therein lies the difference between capital allocation and risk allocation. If asset classes contain many common risk factors, then pursuing diversification and risk mitigation by simply combining asset classes is not enough.

Achieving better diversification needs to go beyond carving the asset allocation “pie” into many slices (or asset classes). True diversification is achieved by baking a pie that consists of several unique, distinct ingredients (risk factors). By focusing on asset class “labels” rather than on underlying risk factors, many investors lose sight of the actual sources of return (and risk) within their portfolios.

As illustrated in Figure 5, the equity risk factor (or sensitivity to overall economic growth and corporate profitability) is found within a number of assets, including U.S. equities, high-yield debt and hedge funds, among others. Similarly, interest
rate risk can be found within bonds, real
estate and U.S. equities, among others.

In 2008, the realized drawdowns on
certain fixed income and hedge fund
asset classes exceeded expected draw-
downs given that both asset classes had
significant exposure to common risk
factors whose risk premiums widened,
including credit risk and equity risk.

Ultimately, asset class returns are a
function of their exposure to underlying
risk factors and are not driven by tradi-
tionally defined “names” for supposedly
different asset classes (like stocks, bonds,
hedge funds and private equity).

In addition, the behavior of those
risk factors (i.e., risk premiums widen
or narrow) is varied across different
economic and market conditions. By fo-
cusing on risk factors rather than asset
classes, investors can better understand
the sources of risk and return within
their portfolios, better position their
portfolios for specific economic/market
conditions, and achieve better diversi-
fication by reducing risk factor redun-
dancies and targeting specific exposure
levels consistent with their unique in-
vestment objectives and risk tolerances.

The Behavior of Asset Classes
in Various Economic Regimes

As previously mentioned, asset class
returns are driven by exposure to and
the behavior of various risk factors.
Risk factors behave differently across
different economic regimes (or funda-
mental economic conditions). By way
of example, economic regimes include
economic expansion or contraction
and rising or falling interest rates or in-
flation. Therefore, asset class returns
are a function of risk factors which are, in
turn, a function of economic regimes.

As illustrated in the simple matrix
shown in Figure 6, asset class perfor-
mance can vary considerably under dif-
ferent economic regimes. Importantly, by
emphasizing equity risk in portfolio con-
struction, most long-term defined benefit
plan investors with relatively high invest-
ment return targets effectively build a
portfolio where investment returns are
highly sensitive to changes in economic
growth. This type of portfolio will gen-
eral perform well when the economy is
expanding, but perform poorly if other re-
gimes dominate the economic landscape. Obviously, the most recent economic
regime (e.g., the economic crisis period)
was generally marked by falling growth
and falling inflation (deflation), favoring
government bonds and liquid assets.

Conclusion

The objective of this article was to
summarize how portfolio risk and di-
versification is traditionally viewed and
evaluated by employee benefit plan
trustees and fiduciaries and to point
out some significant caveats and limita-
tions to this approach.

As noted, traditionally defined as-
et classes share common risk factors,
resulting in investment portfolios that
are not as diversified as expected. Given
that many investment portfolios have
relatively high return objectives and
redundant risk factors, many of these
portfolios often lack meaningful diver-
sification, despite having allocated cap-
ital to a large number of asset classes.

Obviously, the economic crisis of
2008 presented challenges for all in-
vestors. As investors seek to navigate
the highly uncertain future, managing
risk through portfolio diversification is
as important as ever. Therefore, now is
a good time to take a fresh look at asset
allocation and portfolio structure and
make sure an investment program is
structured appropriately.

Endnotes

1. Mathematically, standard deviation is
equal to the square root of variance.
2. Calendar-year returns of the S&P 500 less
three-month U.S. Treasury bills.
3. Data reflects Barclays Capital Government
Bond Index, Barclays Capital High Yield Corpo-
rate Index and S&P 500 Index.

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