1st Global®
RESEARCH & CONSULTING

THE EFFICIENT DIVERSIFICATION OF **MULTI-ASSET CLASS PORTFOLIOS**

A User's Guide to Strategic Asset Allocation

January 2017

1st Global's Investment Management Research Group

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Foreword

The best-laid schemes o' mice an' men
Gang aft agley,
An' lea'e us nought but grief an' pain
For promis'd joy!

– Robert Burns

This white paper presents the assumptions and procedures behind 1st Global's risk-return tradeoff curve and its associated "efficient portfolios." Not all human risk is financial, and not all financial risk is portfolio; but the latter is an important source of human risk, and the financial advisor should help his or her client understand it as best as possible. In particular, the financial advisor should help the client understand that "there is no free lunch," and that there is a tradeoff between less volatility in the short run versus greater growth in the long run. One of the most important tasks of the financial advisor is to help the client choose the right combination of risk and return — "right," that is, for the specific client given his or her wealth, age, financial needs and objectives, risk-tolerance, and the like.

We (i.e., 1st Global and the present writer, who serves as a consultant to the firm) believe that a financial advisor will use the risk-return tradeoff curve of Modern Portfolio Theory (MPT) more effectively if the advisor knows, in general, the assumptions behind MPT and the specific assumptions and procedures behind the particular product in hand. For example, contrary to views expressed by some MPT critics, the inputs to an MPT analysis are not supposed to be historical average returns, volatilities and correlations. Rather they should be forward-looking estimates. But what specific forward-looking adjustments to historical quantities has 1st Global made for its current MPT analysis, and why?

Despite our best efforts, it is always possible that an event will happen comparable to the farmer's plough destroying the poor field mouse's nest in Robert Burns' poem. But that does not mean that field mice should not prepare nests or that financial advisors should not help clients plan. A mutant field mouse couple (who lived in Scotland rather than Southern California) who did not prepare a nest for the winter for themselves and their children would have their genes deleted from the field (a.k.a. the European wood) mouse gene pool by spring. While it is true that the well-advised investor may encounter unanticipated hardships, the ill-advised investor courts almost certain disaster.

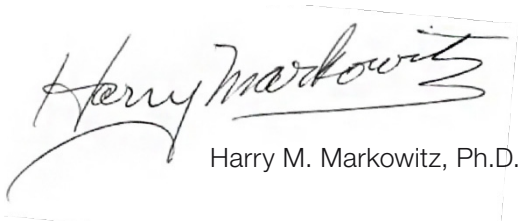
The oft-quoted couplet by Burns that heads this foreword does not end the poem. It is followed by:

Still thou art blest, compared wi' me!
The present only toucheth thee:
But och! I backward cast my e'e,
On prospects drear!
An' forward, tho' I canna see,
I guess an' fear!

It may be that humankind's ability to look back and its instinct to try to look forward may sometimes be dreary and fearful. However, it is what makes a man a man and not a mouse. True, a man or woman is taller and heavier than a mouse and has opposable thumbs, but an elephant is taller and heavier still, and the great apes have opposable thumbs. However, these beasts are not threatening man's extinction by encroaching on his natural habitat. It is vice-versa because of humankind's ability to think, speak, read and write, control fire, and use tools like spears, bows and arrows, cannons, aircraft carriers, telephones, the Internet, and efficient frontiers.

We should view past errors and adversities as learning opportunities, plan as best as we can, look to the future with joy and hope, and always remember the words of Ecclesiastes 9:11 from the Bible:

[T]he race is not to the swift,
Nor the battle to the strong,
Neither yet bread to the wise,
Nor yet riches to men of understanding,
Nor yet favor to men of skill;
But time and chance happeneth to them all.



Harry M. Markowitz, Ph.D.

Introduction

"The future is uncertain, so we can never know what will happen. Indeed, risk would not exist if we could correctly anticipate the future."[1]

One of the most important realities of successful investing is that the future is unknown. While this statement may appear obvious, investors often fail to appreciate the uncertainties they face. A thoughtful assessment of many of the most catastrophic chapters in the history of financial markets shows that these events can be attributed to investors believing that some segment of the markets provided a reliable source of outsized returns that could be exploited into the near future.

Indeed, market "bubbles" would not exist without a group of market participants willing to inflate asset prices well beyond any reasonable intrinsic value. From tulips in the 1720s to Internet stocks in the 1990s to real estate in the 2000s, market excesses and their resulting declines are all similar in that they were driven by a common belief that specific investments would continue to rise. Stated differently, investors believed the future was more certain than it actually turned out to be. All of these periods eventually resulted in a destruction of investor wealth, especially for those least grounded in the concepts of sound investing. Those who believe that the future is knowable consistently set themselves up for disappointment.

Investors who have met financial ruin have often been those who have failed to consider uncertainties in their investment decisions. While investors have long been able to develop expectations about the returns that were achievable from the investments they considered, they did not always have a way to understand or compare the uncertainties presented by those investments. This meant that risk was an undefined concept that investors simply had to accept in pursuing returns.

In 1952, in his first published article titled "Portfolio Selection," Dr. Harry Markowitz provided a framework for how investors could most effectively face uncertainty. In his 1959 book titled "Portfolio Selection: Efficient Diversification of Investments," Markowitz expanded on his ideas and focused on making the concepts of portfolio theory accessible to all investors. These works provided the definition of risk that is most commonly used in the financial industry today. His insights into the development of efficient portfolios provided a process by which investors could achieve the greatest returns for the amounts of risk they were willing to accept. Not only did Markowitz define risk, but he also gave investors the ability to choose just how much risk they would accept.

The concepts of portfolio selection presented by Markowitz have since become known as Modern Portfolio Theory (MPT). Today, his ideas are a ubiquitous part of the modern financial landscape. MPT is applied by some of the world's largest institutions and is the most commonly used investment approach in helping individuals plan their financial futures. Considering the impact that his ideas have had on the financial world and on the lives of investors, it is not surprising that Markowitz was awarded the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel in 1990.

As part of an ongoing commitment to providing sound investment guidance firmly based in academic research, 1st Global engaged Markowitz as a consultant to our investment committee. As part of a comprehensive review of 1st Global's asset allocation models, 1st Global had the privilege of exploring the concepts and methodologies that are the basis of efficient portfolio construction with Markowitz.

[1] Bernstein, P.L. "Risk: The Hottest Four-Letter Word in Financial Markets." CFA Institute Conference Proceedings Quarterly (2006): pp. 10–15. New York City: CFA Institute.

The paper has been organized into three parts. Each focuses on a distinct part of understanding the MPT investing process: **theory**, **application** and **practice**. The first part, theory, provides a brief history of MPT and presents the foundational concepts that are necessary to understanding why investors should use MPT and how it works. The second part, application, details 1st Global's efforts in applying the concepts of MPT in the development of our model portfolios. The final part, practice, affords practitioners insights regarding the characteristics of portfolio efficiency. While many of the processes that make up MPT presented in this paper are deeply rooted in mathematics, the rationale for their use is based on very human concepts that explain how investors "ought" to act when faced with uncertain futures. Ultimately, MPT explains how investors facing uncertainty can most effectively incorporate their beliefs and convictions about the future into their investment decisions.

I. Theory

Investors Facing Uncertainty

Investing Before Modern Portfolio Theory (MPT)

"Nothing more deeply divides us from the world before 1952 than the belated recognition of risk as the dominant element in portfolio management."[2]

Without the benefit of a reliable crystal ball to peer into the future, investors have always had to contend with making decisions about their investments without the information necessary to provide certainty about future outcomes. One of the ways that investors have dealt with this inevitable uncertainty and the risks it presents is diversification, which is one of the most fundamental concepts of investing.

Diversification simply means not putting all of your eggs in one basket or, in investing terms, keeping the fortunes of any single investment from having a significant impact on the entirety of your own fortune. The idea of not putting all of your eggs in one basket, however, fails to provide insight into how to diversify. While it is clear that the notion of diversification existed well before the development of modern portfolio construction processes, what was missing was a clear understanding of how investors should approach the process of diversification. Consider this quote from a 1945 text:

"An examination of some fifty books and articles on investment that have appeared during the last quarter of a century shows that most of them refer to the desirability of diversification.

The majority, however, discusses it in general terms and does not clearly indicate why it is desirable."[3]

Investors often applied diversification crudely, relying on haphazard deliberation, improvised strategies, intuition or even hunches to make their investment decisions.[4] The result for investors was that they often exposed themselves to unnecessary or unintended risks.

Harry Markowitz approached diversification at the portfolio level. His 1952 Journal of Finance article titled "Portfolio Selection" provided investors with the answer as to how they should approach diversification. The paper described a theory and methodology for the efficient diversification of portfolios. The theory began with the recognition that investors facing uncertain outcomes have always had to make investment decisions based on their beliefs about the future of the investments they selected. In fact, the first three lines of the article explained, ***"the process of selecting a portfolio may be divided into two stages. The first stage starts with observation and experience and ends with beliefs about the future performances of available securities. The second stage starts with the relevant beliefs about future performances and ends with the choice of portfolio."[5]***

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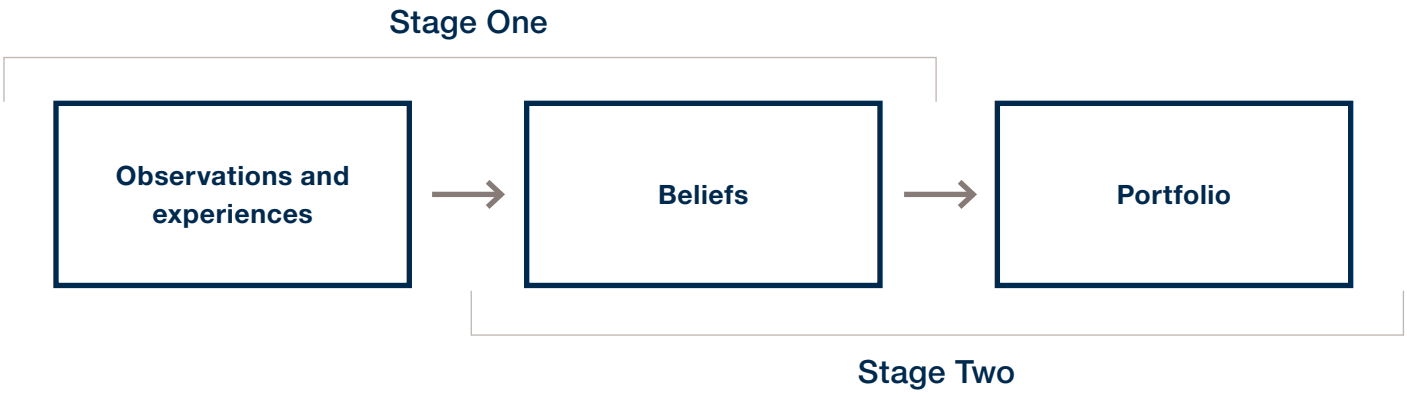
[2] Bernstein, P.L. Capital Ideas Evolving. Hoboken, New Jersey: John Wiley & Sons, Inc., 2007.
[3] Leavens, D.L. "Diversification of Investments," Trusts and Estates (May 1945): pp. 469–473.
[4] Bernstein, P.L. "Then and Now in Investing and Why Now is So Much Better." Ed. F.J. Fabozzi and H.M. Markowitz. The Theory & Practice of Investment Management. Hoboken, New Jersey: John Wiley & Sons, Inc., 2002: pp. xiii–xviii.
[5] Markowitz, H.M. "Portfolio Selection." The Journal of Finance, Vol. 7, No. 1, 1952: pp. 77–91.

Figure 1: The Fundamentals of the Portfolio Selection Process



It is both evident and intentional from the very introduction of the concept of asset allocation that the beliefs we hold are at the core of the portfolio selection process. In this sense, it is important to understand that the process represents not only a diversification of assets or asset classes but also a diversification of the beliefs regarding the expected returns and risks of those investments or asset classes.

While investors had already developed several methods for arriving at a security's expected return, there was no common or specific measure of investment risk. For this, Markowitz recommended that risk be measured in terms of a portfolio's variance. Variance, however, is expressed in terms of units squared. Risk in these terms is difficult for investors to conceptualize, so it is useful to express it in the same units as expected returns. This conversion can be done easily by taking the square root of variance.

Equation 1: Conversion of Variance to Standard Deviation

$$Standard\ Deviation_A = \sqrt{Variance_A} \text{ or } \sigma_A = \sqrt{\sigma_A^2}$$

Variance expressed in these terms is known as standard deviation, which describes how far, on average, a security's return deviates from the security's average or mean return and incorporates information about the probability of deviations occurring as the investor expects. As rational investors facing uncertainty, we incorporate expectations of variability with our expectations of returns in order to make our investment decisions.

One important item to note regarding risk is the distinction between the financial industry's common use of this term and the more impactful and real meaning of this term to investors. While the term "risk" will be used throughout this paper to describe the volatility of returns, as measured through standard deviation, we recognize two very real facts. First, risk is not confined to any single number. Second, risk for investors is not just the volatility of security, asset class or portfolio returns; rather, it represents the circumstance of not being financially capable to honor the promises they make, such as funding their children's college educations or being unable to provide themselves and their spouses with retirements defined by sustaining the power of choice. These are the risks that have very real impacts on the lives of investors. We understand that the real meaning of risk is something far more significant than changes to account values. Our use of the more standardized term throughout this paper is not intended to diminish the understanding of risk as a much broader concept.[6]

[6] *Asset allocation and diversification do not guarantee a profit, nor do they eliminate the risk of loss of principal. There is no guarantee that any investment strategy will be successful.*

Diversification and Efficiency

Subtly Different, Significantly Important

"Not only does the [expected return-variance] hypothesis imply diversification, [but it also] implies the 'right kind' of diversification for the 'right reason.'"[7]

The selection of variance as a representation of investment risk was not a coincidence. In deliberating variance as a measure of risk, Markowitz looked to a statistical text titled "Introduction to Mathematical Probability" by J.V. Uspensky to determine the method for calculating the variance of a portfolio of assets. The equation revealed that portfolio variance depends not only on the variances of the securities held in the portfolio but also on the covariances or comovements that reflect the relationships between securities.[8]

Equation 2: Variance for a Two-Security Portfolio

$$Var(Portfolio_{A,B}) = w_A^2 Var(A) + w_B Var(B) + 2 w_A w_B Cov(A,B)$$

Where:

w_A=The weight of security A in the portfolio

w_B=The weight of security B in the portfolio

Covariance describes how two securities move in relation to one another. As with variance, it is often useful to express covariance in different, more intuitive terms. A common expression of comovement is correlation. The conversion of covariance to correlation can be done with the equation below.

Equation 3: Conversion of Covariance to Correlation

$$Correlation_{A,B} = \frac{Convariance_{A,B}}{Standard\ Deviation_A\ Standard\ Deviation_B} \quad Or \quad \rho_{A,B} = \frac{\sigma_{A,B}}{\sigma_A \sigma_B}$$

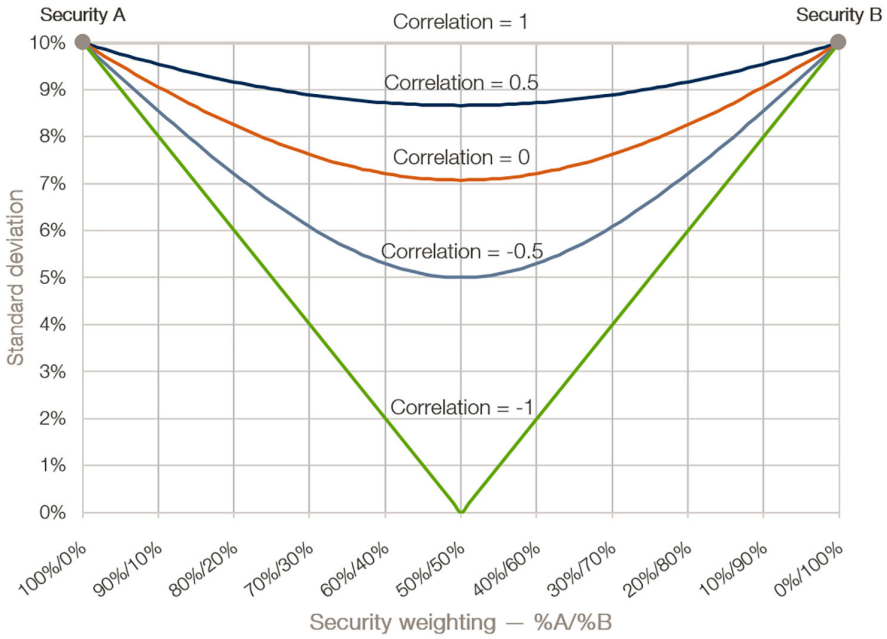
Correlation tells us how closely one security moves in relation to another security and has a value that ranges between 1 and -1. A value of 1 indicates that the two securities move perfectly in tandem. When one security goes up, the other security also goes up. A value of -1 indicates that the two securities move perfectly opposite to one another. When one goes up, the other goes down. Values that fall between 1 and -1 indicate the degree to which two securities move in relation to one another. A value of 0 indicates that there is no relationship between the movements of the two securities. This relationship between securities can have a significant impact on a portfolio's volatility and is a critical insight that is central to understanding how diversification works.

[7] *Markowitz, H.M. "Portfolio Selection." (1952): The Journal of Finance, Vol. 7, No. 1, pp. 77–91.*
[8] *Markowitz, H.M. "Trains of Thought." The American Economist: Journal of the International Honor Society in Economics. 1993: pp. 3–9.*

Let us examine a portfolio of two securities with equal risk, measured in terms of their standard deviations. Figure 2 illustrates how different degrees of correlation between the two securities affect the volatility of portfolios made up of different weights of the two securities.

Figure 2: Correlation and Portfolio Risk

An Examination of a Portfolio of Two Assets with Equal Risk



This is a hypothetical example used for illustrative purposes only and does not represent a specific investment.

For a two-security portfolio, the point at which the maximum correlation benefit can be seen is where the two securities are equally weighted (50 percent security A/50 percent security B). We can see that adding a second security that is highly correlated (correlation = 1) provides no risk-reduction benefit to a portfolio.

Now consider the correlation benefit to the investor of adding a second security that has a correlation of 0.5. In this instance, portfolio volatility is reduced by nearly 15 percent. If the second security was not correlated to the first (correlation = 0), portfolio volatility would be reduced by nearly 30 percent. If both securities A and B had the same expected returns, it becomes clear how an investor, with careful analysis, could potentially achieve the returns provided by both A and B with lower risk than either A or B. This illustrates that it is possible to construct portfolios whose risk is smaller than the sum of their individual parts.[9]

This also makes clear that the act of diversifying a portfolio of securities is much more than simply adding more securities. There is a "right kind" of diversification that provides the "right reason" for adding additional securities or asset classes to a portfolio.

The analysis of portfolios, however, can be a highly intensive computational process that increases in complexity as the number of investments increase. The process requires establishing return expectations for each investment being considered, forming probability beliefs about the investments and determining expectations for the relationships between the investments. This information is then used in a portfolio analysis to identify the set of portfolios from which investors should select.

[9] *Bernstein, P.L. "Portfolio Selection." Fabozzi, F.J., H.M. Markowitz, F. Gupta. The Theory & Practice of Investment Management. Hoboken, New Jersey: John Wiley & Sons, Inc., 2002: pp. 15-42.*

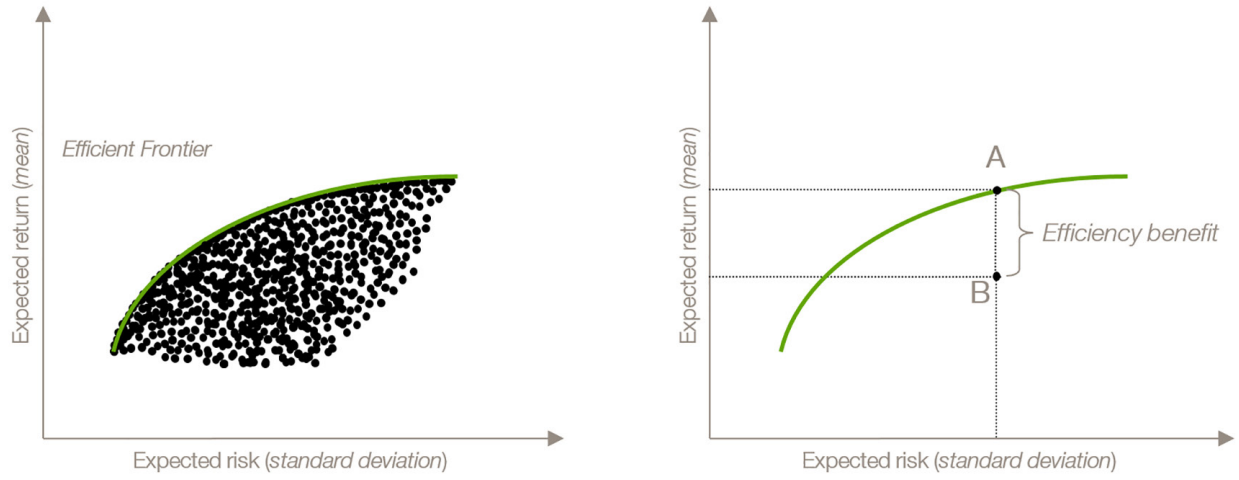
The two-security example that showed how the risk of different portfolios made up by different weights in whole percentages of the two securities required at least 100 calculations. A portfolio analysis that is not limited to whole percentages made up of multiple securities or asset classes could easily require an increasingly large number of computations to determine all of the possible portfolios made up of all of the possible security or asset class combinations used in the analysis.

Markowitz, however, greatly simplified the portfolio analysis process by introducing the "critical line method" for deriving efficient portfolios.[10] This method eliminated the need to calculate returns and risk for all possible combinations of investments being considered, as it directly solves for the set of portfolios with the highest expected returns for given levels of risk — that is, the set of efficient portfolios.

Figure 3 illustrates what the results of a portfolio analysis might look like. In the chart on the left, each dot represents a unique portfolio made up of some combination of securities or asset classes, each with its own risk and return characteristics. Each dot shown is, in fact, a diversified portfolio. The green line shows the set of portfolios identified using Markowitz's "critical line" method. This set of portfolios is often referred to as the "efficient frontier" because these portfolios provide the highest return for a given level of risk.

In the chart to the right in Figure 3, we can see an example of two portfolios. Both Portfolio A and Portfolio B have the same amount of expected risk; however, Portfolio A provides a higher expected return for the given level of risk. In fact, Portfolio A is part of the set of portfolios that formed the efficient frontier. This means that, for that level of risk, there is no other portfolio that provides a higher expected return. Portfolio A is the most efficient portfolio for that given level of risk.

Figure 3: Portfolio Efficiency.[11]



This example illustrates the difference between diversification and efficiency. The important distinction is that diversification merely explains an idea about how to reduce risk, while efficiency represents the maximum expression of diversification based on an investor's expectations about the future. This distinction applies to portfolios of asset classes as well as portfolios of securities.

[10] *Markowitz, H.M. "Portfolio Selection: Efficient Diversification of Investments". 2nd ed. Malden, Massachusetts: Blackwell Publishers, 1991.*

[11] *This does not represent an actual portfolio analysis and is for illustration purposes only.*

Risk and Return

Selecting Optimal Portfolios

The use of risk and return for selecting portfolios is based on the assumption that investors are risk-averse. This means that, given the choice between two investments offering the same expected return, an investor would choose the investment that provides the lowest risk. This is an important distinction because it is the dividing line between the idea that investors simply attempt to maximize expected return and the idea that investors consider risk in making their investment decisions. We can assess a situation in which investors are faced with two investments: one of which offers a high return as well as high risk and another investment that offers a lower return as well as a lower degree of risk. If investors merely sought to maximize expected return, they would simply place all of their assets in the first investment, regardless of the risk implications. In no case would they seek diversified portfolios, as doing so would reduce expected return. This notion, however, is in direct contradiction with the empirical evidence that investors do diversify their assets. We must then reject the idea that investors approach investing with the singular objective of return maximization.

Markowitz suggested that, rather than seeking to maximize expected return, investors should seek the greatest amount of return, given their preferences for risk. It should come as no surprise that every investor is unique in his or her willingness to bear risk. Unfortunately, the process of precisely describing risk and return preferences in the form of a mathematical equation is not, for most investors, a feasible endeavor.[12] What is important to understand is that risk-averse investors, as a whole, demonstrate very similar preferences when it comes to risk and return; they prefer diversified portfolios, and they require greater returns in order to take on greater risk.

In his 1959 book "Portfolio Selection: Efficient Diversification of Investments," Markowitz demonstrated that if each investor examined an efficient frontier and then selected the portfolio most appropriate to his needs based only on risk and return (mean and variance), each would obtain a portfolio almost as good as the very best available to him or her.[13] Later, in several academic papers, Markowitz provided additional support for the idea that MPT provides investors a very simple and effective way to choose a portfolio.[14, 15]

1st Global is focused on providing the necessary resources to help investors understand their preferences or tolerances for risk. 1st Global's risk assessment process guides investors through a set of questions to assess their inclinations for risk and return. The information gathered is then used to provide a recommendation of portfolios that are appropriate for their risk and return preferences and ones that will give the investors confidence that their financial goals will be met.

[12] While an investor's "utility function" may not be ascertained with exact precision, there are processes such as computerized risk assessments that are useful in allowing investors to identify portfolios that closely match their preferences for bearing risk.
[13] Markowitz, H.M. "Portfolio Selection: Efficient Diversification of Investments." 2nd ed. Malden, Massachusetts: Blackwell Publishers, 1991.
[14] Levy, H. and H.M. Markowitz. "Approximating Expected Utility by a Function of Mean and Variance." The American Economic Review. 1979: pp. 308–317
[15] Kroll, Y., H. Levy and H.M. Markowitz.: "Mean Variance Versus Direct Utility Maximization." The Journal of Finance, Vol. 39, No. 1, pp. 47–61.

II. Application

1st Global Asset Allocation Model Development

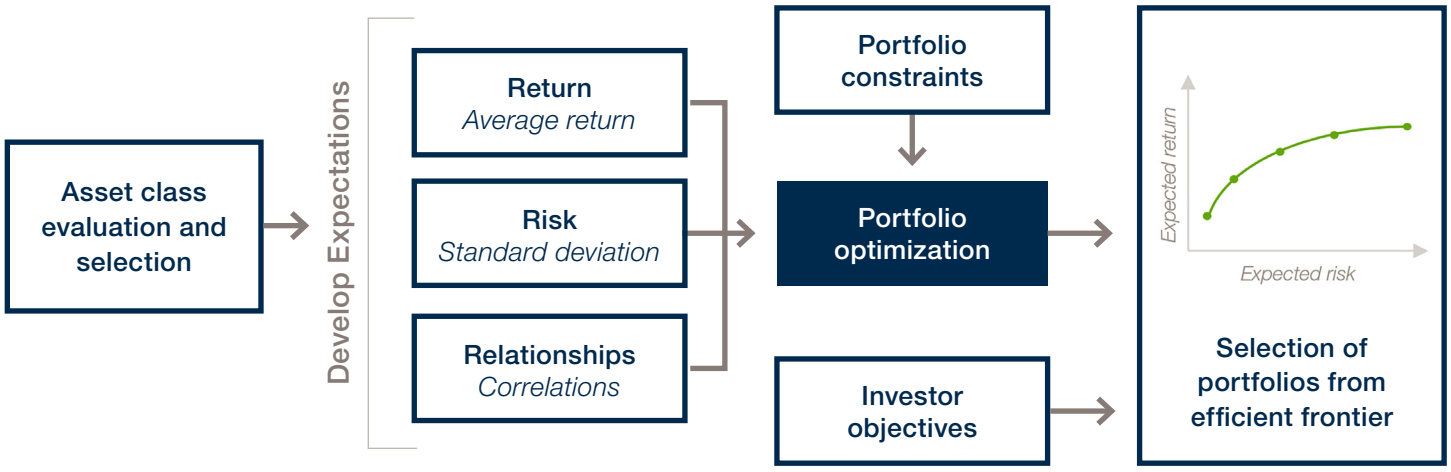
The MPT Investment Process

Up to this point, our discussion has served to provide an overview of the concepts that support the use of MPT as a sound approach to investing. This included the following:

- An understanding that our beliefs about investing are at the core of MPT and how a rational investor should make investment decisions based on those beliefs.
- An overview of what makes diversification work.
- The difference between diversification and efficiency.
- How MPT provides investors a simple and effective approach to maximizing their expected risk-return preferences.

We will now focus on the application of those concepts in practice. Specifically, we will proceed through the development of 1st Global's baseline model portfolios, providing details on specific segments of the process as they are presented. Figure 4 provides an overview of 1st Global's asset allocation development process and will serve as a guide for our discussion regarding portfolio development.

Figure 4: 1st Global Asset Allocation Model Development Process[16]



We will begin our discussion with the evaluation and selection of the asset classes that are included in 1st Global's model portfolios and then proceed to discuss our process for forming beliefs about the future for the selected asset classes based on our observations and experiences. Specifically, we will focus on the primary inputs necessary for an MPT portfolio analysis, which include the following:

1. Return expectations (mean return).
2. Risk expectations (variance/standard deviation).
3. Expectations for relationships between asset classes (covariance/correlation coefficients).

Once forward-looking expectations are developed, we will describe the optimization process and the role of constraints in portfolio development. Finally, we will discuss how portfolios are selected from the derived efficient frontier.

[16] *Fabozzi, F.J., F. Gupta and H.M. Markowitz. "The Legacy of Modern Portfolio Theory." The Journal of Investing (2002): pp 7–22.*

Evaluation and Selection of Asset Classes

Asset classes can be evaluated by focusing on three characteristics: return, risk and correlation. While we can observe quantitative data in making decisions, it is also necessary to understand qualitatively why an asset class exhibits its particular risk, return and correlation characteristics as well as how those characteristics are related to other asset classes that are included in a portfolio. Developing this understanding is part of the process of being able to formulate expectations about the future. An understanding of why the asset class has performed well is more important in forming beliefs. Portfolios should include asset classes that react differently to different economic environments and that can withstand unexpected geopolitical events.

The evaluation and selection of asset classes is a critical consideration in the development of efficient portfolios. Asset classes should be distinct, clearly defined and provide specific benefits to portfolios. The asset classes and the representative benchmark index return series selected for inclusion in 1st Global's model portfolios are shown in Table 1 below.

Table 1: 1st Global Selected Asset Classes

Asset Class	Benchmark	Inception Date
Cash	Bloomberg Barclays U.S 1–3 Month T-Bill TR	January 1992
Fixed income	Bloomberg Barclays U.S. Aggregate Bond TR	January 1976
U.S. large-cap equity	S&P 500 Total Return USD	March 1957
U.S. small-cap equity	Russell 2000 Total Return USD	December 1978
International developed markets equity	MSCI EAFE GR USD	January 1970
International emerging markets equity	MSCI Emerging Markets GR USD	January 1988
Real estate securities	FTSE NAREIT Equity REIT Total Return USD	January 1972
Commodities	Bloomberg Commodity Total Return USD	January 1991

The Characteristics and Portfolio Contributions of Selected Asset Classes

There are not many asset classes that can provide significant correlation benefits to portfolios; however, asset classes with limited diversification benefits still play important roles. Many have unique qualitative characteristics that can be beneficial to investors.

Investors who have a clear understanding of the specific characteristics that provide the basis for the inclusion of asset classes are better able to evaluate investments to be used in the effective implementation of multi-asset class portfolios. Table 2 on the following page provides a summary of the distinct characteristics, defined portfolio roles and specific portfolio benefits provided by selected asset classes.

Table 2: A Summary of 1st Global Asset Class Characteristics, Roles and Benefits

Asset Class	Distinct Characteristics	Defined Portfolio Role	Specific Portfolio Benefit
Fixed income	Fixed income represents a debt obligation of issuers that provides a contractual payment of interest and principal. Fixed income generally offers lower expected returns than equity asset classes.	Diversification; preservation of capital during periods of financial stress; income	Income; volatility reduction; preservation of capital during periods of financial stress
U.S. large-cap equity	Access to some of the world's largest, most well-known businesses (equity risk premium)	Return; diversification	Access to some of the world's largest, most well-known businesses; long-term inflation hedge
U.S. small-cap equity	Smaller companies tend to have higher costs of capital. Over the long term, small-company equities have provided higher rates of return than large-company equities and at greater risk (equity risk premium and size premium)	Return; diversification	Possibility of higher rates of return than large company equities and with greater risk
International developed markets equity	Expands investment opportunity set to include international developed markets; foreign currency exposure	Return; diversification	Expanded investment opportunity set; access to some of the world's largest, most well-known businesses domiciled outside of the U.S.
International emerging markets equity	Expands investment opportunity set to include international emerging markets; foreign currency exposure	Return; diversification	Expanded investment opportunity set; access to one of the fastest growing segments of the global markets
Real estate securities	Returns are driven by lease payments. Leases tend to be more stable than corporate earnings.	Return; diversification	Risk reduction; long-term inflation hedge
Commodities	Returns are driven primarily by supply and demand. Changes in commodity prices can affect corporate earnings and the global economy.	Diversification	Risk reduction; unexpected inflation hedge; "event risk" hedge

Investing in fixed-income securities involves special risks not typically associated with equity securities. These risks include credit risk, which is the risk of potential loss due to the inability to meet contractual debt obligations, and interest rate risk, which is the risk that an investment's value will change due to a change in the level of interest rates. Additionally, there is an inverse relationship between bond prices and interest rates specific to fixed-income securities. As interest rates rise, bond prices fall, and conversely, as interest rates fall, bond prices rise.

Investing in micro or small-sized companies may involve risks not associated with investing in more established companies. Because equity securities of smaller companies may not be traded as often as equity securities of larger, more established companies, it may be difficult or impossible for the securities to sell.

International investing presents certain risks not associated with investing solely in the United States. These include risks relating to fluctuations in the value of the U.S. dollar relative to the values of other currencies, custody arrangements made for foreign holdings, political risks, differences in accounting procedures and the lesser degree of public information required to be provided by non-U.S. companies.

Investing in emerging markets involves greater risk than investing in more established markets. Such risks include exchange rate changes, political and economic upheaval, the relative lack of information about these companies, relatively low market liquidity, and the potential lack of strict financial and accounting controls and standards.

An investment in commodity-linked derivative instruments may be subject to greater volatility than investments in traditional securities and are not suitable for all investors.

Fixed Income

Bonds represent debt obligations issued by either governments or corporations. These debt obligations include contractual requirements regarding when debt is to be repaid as well as the amount and timing of interest payments that issuers must pay owners of the debt obligations. Bonds are often referred to as "fixed income" because they generally provide a series of fixed interest payments along with a final principal payment. The quality of fixed income is determined by the issuer's ability to pay interest payments and return principal at the maturity of the bond.

Bonds play an extremely important role in portfolios for investors. A review of Table 3 below shows that it exhibits low correlations to nearly every asset class included in 1st Global's model portfolios. This makes it one of the most useful asset classes available in providing significant diversification benefits to portfolios. Few investments can reduce portfolio volatility as effectively. The expected return on investment-grade domestic fixed-income securities is lower than domestic stocks; however, its inclusion in portfolios is not intended to increase returns. It is included in portfolios to reduce risk and, for some investors, to generate income. In addition, if the asset class is implemented with higher-credit-quality fixed-income securities, it can help protect investor portfolios in times of financial crisis.

Table 3: Historical Monthly Correlations of Fixed Income with Selected Asset Classes

January 1992 – December 2016[17]

Asset Class	Correlation
Cash	0.36
U.S. large-cap equity	0.04
U.S. small-cap equity	-0.07
International developed markets equity	0.05
International emerging markets equity	0
Real estate securities	0.19
Commodities	0.05

U.S. Large-Capitalization Equities

The returns from equities differ from the returns provided by fixed income. While fixed income generally represents a debt obligation that provides a periodic interest payment, owning equity means actually owning a portion of a company. Equity ownership allows investors to benefit from the earnings generated by a business as well as expectations for future profits. Equity returns have two components: dividends and capital appreciation.

Dividends represent an equity owner's interest in company profits paid out in either cash or additional shares. Capital appreciation represents an increase in the value of a company, which can be either real or perceived. Earnings and expectations for future earnings growth can be affected by such things as the business cycle, labor costs, management skill and government regulations, to name a handful. Additionally, equity interests are subordinate to debt obligations. In light of these risks, the returns provided by equities tend to be more volatile than those provided by fixed-income securities. Return expectations tend to be greater for equities than fixed income and can be summarized in the concept of an "equity risk premium," which is defined as the amount of return in excess of an ultra-low risk government bond that stocks are expected to provide investors for accepting additional risk.

[17] Fixed income represented by the Bloomberg Barclays U.S. Aggregate Bond TR USD Index. Other asset classes are represented by the indices shown in Table 1.

This “risk premium” is a function of how much it costs a company to access new funds to invest in its business, also known as a company’s cost of capital. As companies evaluate their needs for additional capital, they weigh the costs of accessing additional funds against the expected profits that will be generated from deploying those assets. If a company can earn a return that is greater than its cost of capital, then it makes sense to invest more in its business. Otherwise, accessing new capital would generate a loss. This provides a fundamental reason for owning equities and also highlights the importance of capable company management in effectively utilizing corporate capital over time to generate returns above the cost of capital.

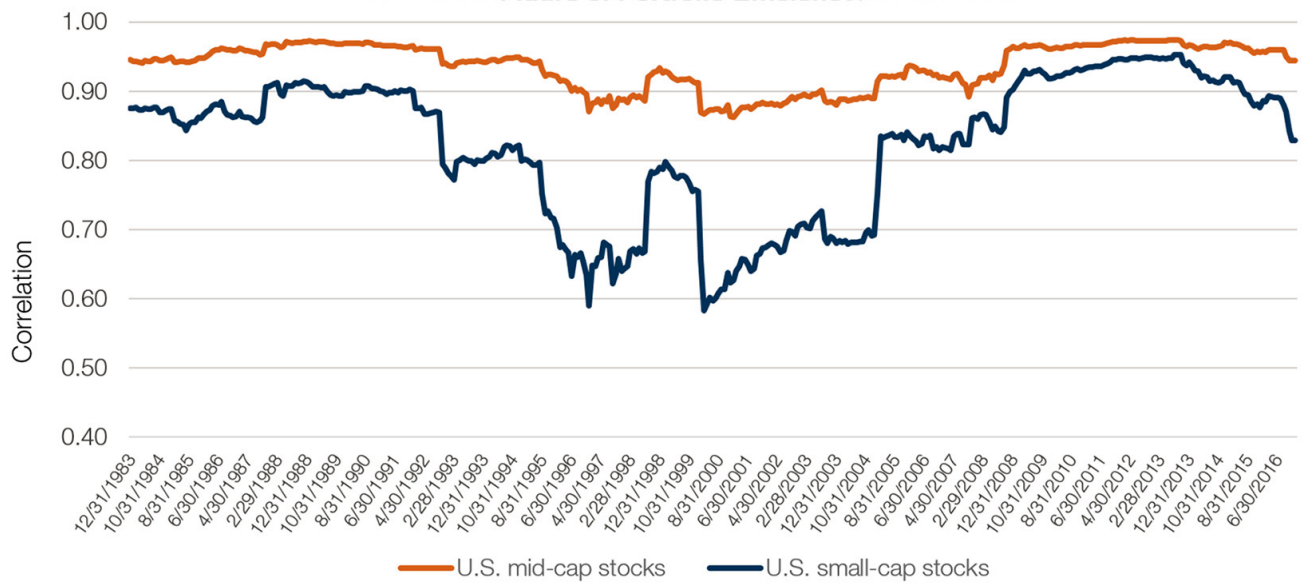
One of the most commonly followed indicators of U.S. equity market performance is the S&P 500 Index, which is made up of the 500 largest U.S. companies that are some of the most well-known businesses. Access to the equity risk premium is gained by including U.S. large-capitalization equities or any other equity security in a portfolio.

U.S. Small-Capitalization Equities

The inclusion of U.S. small-capitalization companies in 1st Global model portfolios is based on empirical evidence that, over long-term investing horizons, smaller companies have provided investors with higher rates of return and some diversification benefits. Smaller companies tend to have higher costs of capital than larger established businesses and are considered to carry more risk. In addition, empirical evidence has indicated that a higher expected return for smaller company stocks might be due to other factors such as thin liquidity. This excess return is known as the “size premium,” which is defined as the difference between small and large company returns. It is not a premium that occurs every year, nor is it predictable.

The relationship between company size and returns has been documented in several academic studies, including by Rolf W. Banz in a 1981 study in the Journal of Financial Economics and by Eugene Fama and Kenneth French in their 1992 study in the Journal of Finance. Figure 5 shows the differences between small and mid-sized companies in terms of their correlations to U.S. large-capitalization equities over five-year rolling time periods since January 1979.

Figure 5: Historical Rolling Five-Year Correlations of Selected Asset Classes with US Large-Cap Stocks
January 1979 – December 2016



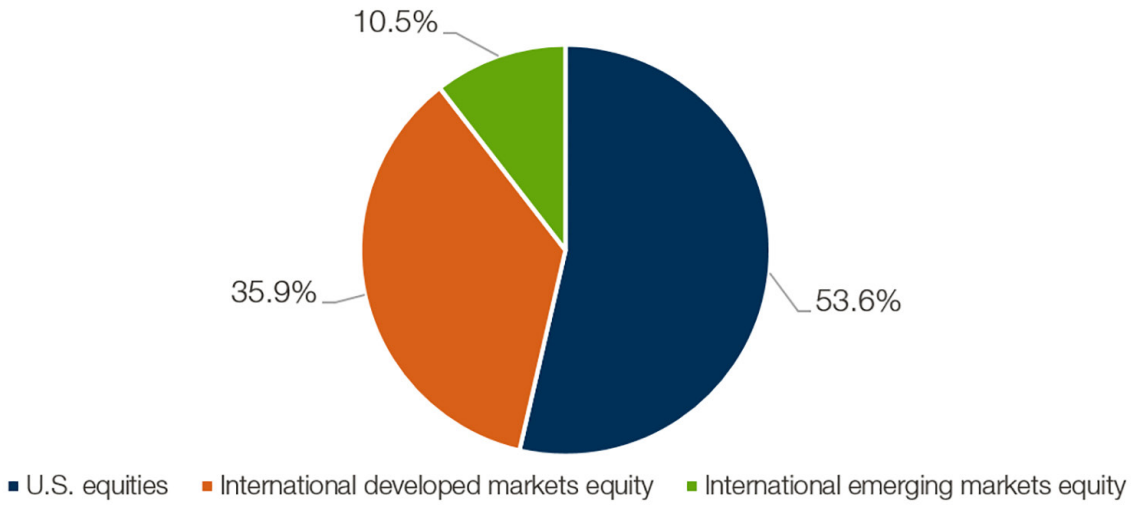
U.S. large-cap stocks — S&P 500 TR USD, U.S. mid-cap stocks — Russell Midcap TR USD, U.S. small-cap stocks — Russell 2000 TR USD
An investment cannot be made directly in an index. Past performance does not guarantee future results.

International Developed and Emerging Market Equities

International stock markets in both developed countries and emerging countries have become an increasingly important part of the investing landscape, and there is ample evidence that investors can gain considerable benefits from taking a global view of investing. Figure 6 (shown below) shows the makeup of the global equity markets by market capitalization, which is the market value (number of shares outstanding times price per share) of the companies in each specified segment.

This chart highlights that the U.S. equity market does not represent the complete investment opportunity set available to investors. U.S.-based investors who choose to exclude foreign investments are ignoring nearly half of the opportunities available across the globe. Emerging markets, while a much smaller portion of global markets, also represent a notable portion of global opportunity set. What makes emerging markets compelling is that these markets are likely to experience the fastest rates of economic growth within the global economies.

Figure 6: Equity Market Capitalization by Global Market Segments[18]

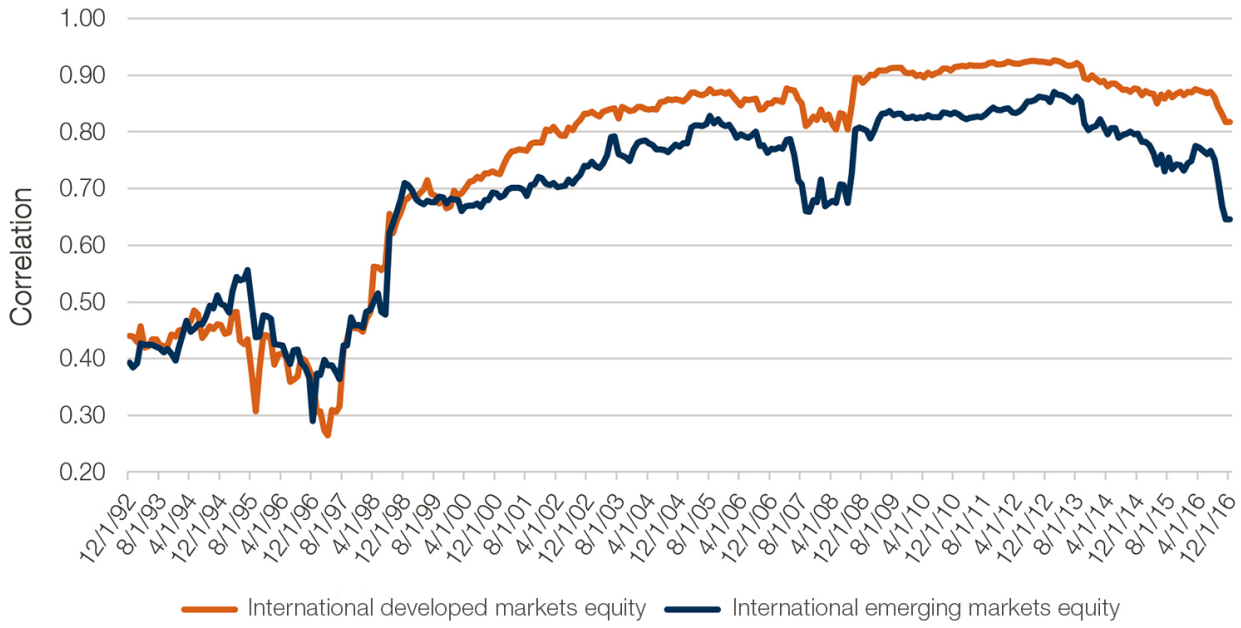


Structural economic differences, along with the significant differences in growth expectations, provide a compelling case for viewing emerging market equities as a unique asset class. The opportunity presented by the inclusion of emerging market equities within portfolios is participation in economies that are both fundamentally different from developed economies and an increasingly important portion of global economic activity. The quantitative benefits of including emerging markets in portfolios can be seen in Figure 7, which shows the rolling five-year correlations between U.S. large-capitalization equities (S&P 500) and both developed and emerging market equities. The differences between emerging and developed markets are reflected in the portfolio diversification benefits provided by each of the two asset classes. While correlations have increased in recent history, there are fundamental reasons that support the notion that investing internationally will continue to provide risk-reduction benefits to portfolios.

[18] *Source: Dimensional Fund Advisors, January 2017*

Figure 7: Historical Rolling Five-Year Correlations of Selected Asset Classes with U.S. Large-Cap Stocks

December 1988 – December 2016



U.S. large-cap stocks — S&P 500 TR USD
International developed market stocks — MSCI EAFE GR USD,
International emerging market stocks — MSCI Emerging Markets GR USD
An investment cannot be made directly in an index. Past performance does not guarantee future results.

When considering international equities for inclusion in a portfolio, a distinction should be made regarding the differences in owning U.S.-based multinational companies that derive large parts of their revenues from foreign markets and owning companies that are based in foreign markets. While the ownership of U.S.-based multinational corporations provides an opportunity to benefit from their access to foreign markets, the performance of these companies is more closely tied to U.S. equity markets than international markets.

Structural differences in the drivers of economic growth between different countries also manifest themselves for U.S.-based investors in the fluctuations seen in the value of foreign currencies relative to the U.S. dollar. Part of owning international companies is accepting the risks associated with the specific currencies of the countries in which those companies are based. Currency fluctuations are a component of international investments that can act as an important portfolio diversifier. They can also represent a significant risk if the majority of international investments within a portfolio are tied to the value of a single economy or region. Just as it is prudent to invest in a broadly diversified group of international companies, it is equally important that the currency exposures represented by those companies also be broadly diversified across multiple economies.

Real Estate Securities

Real estate represents ownership of property, such as commercial, retail and apartments, and undeveloped land. The purchase, maintenance and ownership of individual properties can be an expensive and time-consuming endeavor for individual investors. Direct property ownership can also force investors to accept limited liquidity for assets used to purchase properties. Fortunately, accessing real estate for inclusion in investor portfolios today does not require such a burdensome commitment. One of the simplest and liquid

ways of accessing a diversified mix of real estate assets is through equity real estate investment trusts (REITs), which are companies that purchase, operate and finance properties to generate income. They issue common and preferred stock that trade on the major stock exchanges. The inclusion of real estate in portfolios provides both diversification benefits and capital price appreciation. Table 4 below shows historical correlations of real estate with other asset classes.

Table 4: Historical Monthly Correlations of Real Estate Securities with Selected Asset Classes

January 1992 – December 2016[19]

Asset Class	Correlation
Cash	-0.08
Fixed income	0.19
U.S. large-cap equity	0.55
U.S. small-cap equity	0.62
International developed markets equity	0.52
International emerging markets equity	0.46
Commodities	0.25

In most cases, equity REITs generate their returns from the cash flows provided by rents on properties in which they invest. This is different from the returns generated by equities, which rely on capital gains. The long-term nature of many leases results in rents being more stable than the corporate earnings that drive equity returns. As mentioned, REITs are generally in the business of managing properties for income. They are not required to develop new technologies or bring different products or services to the market like many corporate entities looking to generate earnings. This means that REITs generally face lower levels of business risk than typical businesses.[20] This is not to say that there are fewer risks in real estate — just that there are differences in the types of risks faced by property owners. This is what makes real estate unique: It provides diversification in the types of risks investors accept.

Another key benefit of incorporating real estate into a portfolio is that the asset class can be viewed as a hedge against inflation. This aspect of real estate begins with the concept of replacement cost. In other words, what would be the cost to replace an existing property or build a similar property at today's costs? As the costs of the materials used to build a property increase, so should the value of the property. Additionally, a property owner's ability to adjust rents is an important aspect in understanding real estate as a long-term inflation hedge. As leases expire, property owners can increase rents to pass through inflationary pressures to tenants.[21] Therefore, the sensitivity to inflation demonstrated by different REITs is a function of the lengths of the leases within the REITs.

[19] Real estate securities represented by the FTSE NAREIT Equity REIT TR USD Index. Other asset classes are represented by the indices shown in Table 1.
[20] Swedroe, L.E. J. and Kizer. The Only Guide to Alternative Investments You'll Ever Need. New York, New York: Bloomberg Press, 2008.
[21] Swensen, D.F. Unconventional Success: A Fundamental Approach to Personal Investment. New York, New York: Free Press, 2005.

Commodities

Broadly defined, commodities are principal raw or semi-finished goods used by producers and consumers.[22] Some common examples of commodities include crude oil, copper, gold, sugar, corn, and live cattle. Global commodity prices are primarily driven by supply and demand dynamics, which can impact consumers as rising costs for goods derived from commodities, such as corn and wheat, can rise and fall significantly in a relatively short period.

Additionally, changes in commodity prices along the supply chain can impact the cost of goods. For example, an increase in the price of oil would likely lead to an increase in the cost of transporting goods, which would result in a price increase to consumers of a broad range of goods.

While the commodity asset class has been quite volatile over the last several years, viable reasons remain for its continued inclusion in a diversified multi-asset class portfolio. We believe that a diversified basket of commodity futures should continue to be classified as a separate asset class. The pattern and variance of returns for commodities is sufficiently different from that of stocks and bonds, and the correlations with the other major asset classes range from a low of near 0.1 to a high around 0.6.

Therefore, the diversification benefits remain. In addition, during periods of unexpected spikes in commodity-driven inflation, exposure to commodities will benefit a portfolio.

Over the last 10 years, the nature of the types of investment vehicles available to retail investors to invest in commodity futures has changed. The number of mutual funds attempting to capture the returns of a basket of commodities futures has risen, and with this increase has come a shift in investor preferences of the underlying benchmark against which most of these mutual funds are indexed. Currently, most open-end commodity mutual funds are benchmarked to the Bloomberg Commodity Index Total Return. Recently, 1st Global moved to the using the Bloomberg Commodity Index as the proxy index for the commodity asset class.

The Bloomberg Commodity Index is designed to be a liquid and diversified benchmark for commodities investments. The index uses a consistent, systematic process to represent the commodity markets. A commodity index should fairly represent the importance of a diversified group of commodities to the world economy. To achieve a fair representation, the Bloomberg index uses both liquidity data and U.S.-dollar-weighted production data in determining the relative quantities of included commodities. A major goal of the Bloomberg Commodity Index is to provide diversified exposure to commodities as an asset class. Disproportionate weighting of any particular commodity or sector increases volatility and negates the concept of a broad-based commodity index. Instead of diversified commodities exposure, the investor is unduly subjected to microeconomic shocks in one commodity or sector. The value of the index is computed based on hypothetical investments in the basket of commodities that make up the index. The index embodies four main principles in its design: economic significance, diversification, continuity and liquidity.

The following diversification rules have been established for the Bloomberg index and are applied annually:

- No single commodity (e.g., natural gas and silver) may constitute more than 15 percent of the index.
- No single commodity, together with its derivatives (e.g., WTI crude oil and Brent crude oil, together with diesel and unleaded gas), may constitute more than 25 percent of the index.
- No related group of commodities (e.g., energy, precious metals, livestock or grains) may constitute more than 33 percent of the index.
- No single commodity (e.g., natural gas and silver) may constitute less than 2 percent of the index as liquidity allows. (This rule helps to increase the diversification of the index by giving even the smallest commodity within the basket a reasonably significant weight.)

[22] *Swedroe, L.E. and J. Kizer. The Only Guide to Alternative Investments You'll Ever Need. New York, New York: Bloomberg Press, 2008.*

Capital Market Assumptions

Asset Class Return Expectations

Capital market assumption (CMAs) serve as critical inputs to any multi-asset class investment optimization exercise. The development of return expectations should begin with the understanding that there is no way of predicting future returns with certainty. In making investment decisions, however, it has always been necessary to have a belief about the future performance of specific investments. Therefore, it is necessary to establish a reasonable foundation on which to build return expectations. There are several common methods that allow for the incorporation of beliefs about the future in establishing forward-looking estimates of asset class returns, including complex economic models, risk premium approaches and equilibrium models.

History provides a valuable lesson and can serve as a strong foundation for forward looking return estimates; however, historical return data are not meant to be used as inputs in MPT analysis unchecked. This is due to empirical evidence that the volatility of annual returns is much higher than that of the other MPT inputs (standard deviation and correlation), and it has been suggested that annual returns have a higher impact in a typical MPT exercise than the other two parameters. Because of these issues, 1st Global relied more heavily on third-party estimates (e.g., survey of outside firm expectations, internal opinion survey and qualitative/ quantitative rationales) for returns.

The expected returns were estimated with a combination of the following factors:

- External surveys of investment firms opinions.
- An analysis of certain segments of historical returns dependent upon factors relevant to each asset class.
- Internal discussion of relevant factors that could influence historical views.

1st Global used the results of the Horizon Actuarial Survey[23] to provide us with a robust framework of consensus institutional opinion on future returns. Horizon Actuarial is a well-known consulting firm specializing in providing actuarial solutions for multiemployer benefit plans. The survey aggregates the responses and provides the median of those responses. Additionally, 1st Global reviewed the insights of leading financial institutions and investment managers to gauge the outlook of equities, bonds, real estate securities, commodities and other asset class over the next 10-year time horizon. The incorporation of this information allowed for the inclusion of a number of different return estimate methodologies utilized by independent market participants. Lastly, each member of 1st Global's Investment Management Research Group provided his guidance on expected asset class returns. These estimates were then consolidated to arrive at 1st Global's expected returns. This process ensured the following:

- Return expectations would not be critically out of line with reality and the historical relationships between asset classes.
- That anticipated market conditions over the intermediate-term future were shaped by an analysis of current market valuations, sentiment and activity. An example is the current normalization of the Federal Funds interest rate by the U.S. Federal Reserve.
- Final number reflects a "best efforts" belief about the future — not mechanistically determined figures.

The combination of internally generated market-observable expectations and independent external expectations provides an unbiased foundation for the return estimates used to develop 1st Global's asset allocation models.

[23] *See Appendix for a list of firms participating in the Horizon Actuarial Survey.*

Table 5: Expected Asset Class Returns

	Cash	Taxable Fixed Income	Municipal Fixed Income	U.S. Large-Cap Equity	U.S. Small-Cap Equity	International Developed Markets Equity	International Emerging Markets Equity	Real Estate Securities	Commodities
Expected returns*	2.2%	4%	4.08%	7.13%	7.83%	7.6%	9.3%	7.8%	5.1%

Source: 1st Global Advisors, Inc. as of August 2016.
**Arithmetic annual returns — forward-looking 10-year time horizon. These capital market assumptions/expectations are subject to change. The estimated expected returns are forward-looking projections based on our firm's research and a survey of forecasts from outside investment firms. Estimated expected returns should not be construed as projecting or predicting actual returns of any specific investments.*

Asset Class Risk Expectations

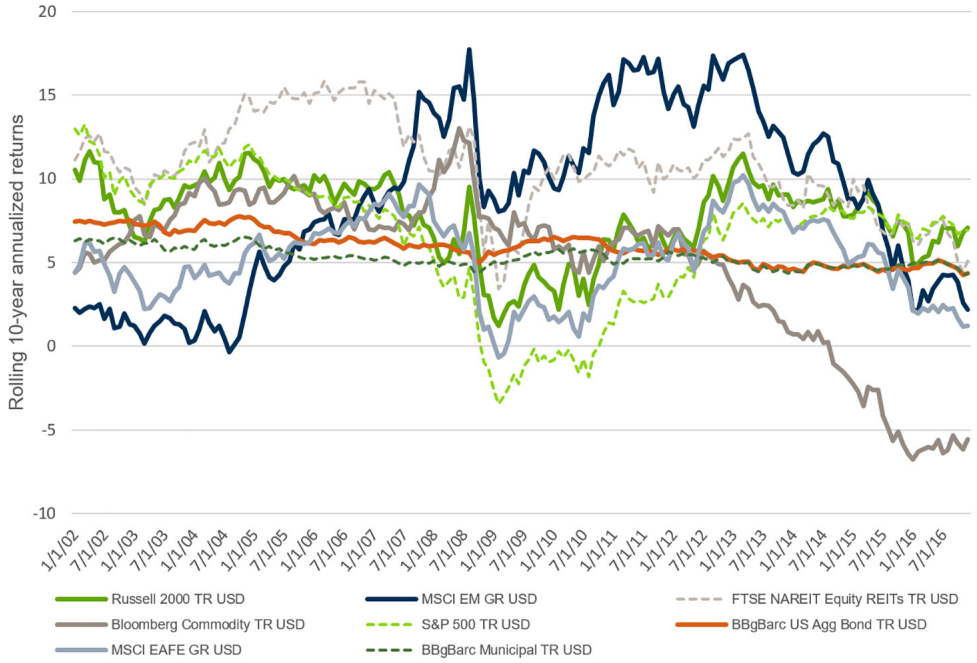
The understanding of the risks presented by individual asset classes and the relationships between asset classes is crucial in the development of portfolios that lie on the efficient frontier. In our research, empirical evidence backs up the intuition that historical volatilities (risk) are much more stable over time than historical returns. Volatilities over various rolling windows (see Figure 9) have a tendency to drift up and down with an occasional structural shift upward during a severe market correction or regime change (such as the impact of the "Great Financial Crisis"). Asset class returns, on the other-hand, even on a long-term rolling basis during similar timeframes, can vacillate dramatically (see Figure 8).

Because volatilities tend to be more stable over time, 1st Global advocates looking carefully at what history has told investors can be expected for the standard deviation of returns of an asset class. It is important to conduct rolling time-period analyses and to review what structural factors might influence the volatility of an asset class going forward. These structural factors could include high-speed algorithmic trading for equities or the absence of investment firms holding bond inventory for sale.

To illustrate the stability of volatilities versus expected returns, Figure 8 and Figure 9 show rolling 10-year annualized returns and volatilities over common history for each asset class involved in the analysis:

Figure 8: Rolling 10-Year Annualized Returns by Asset Class

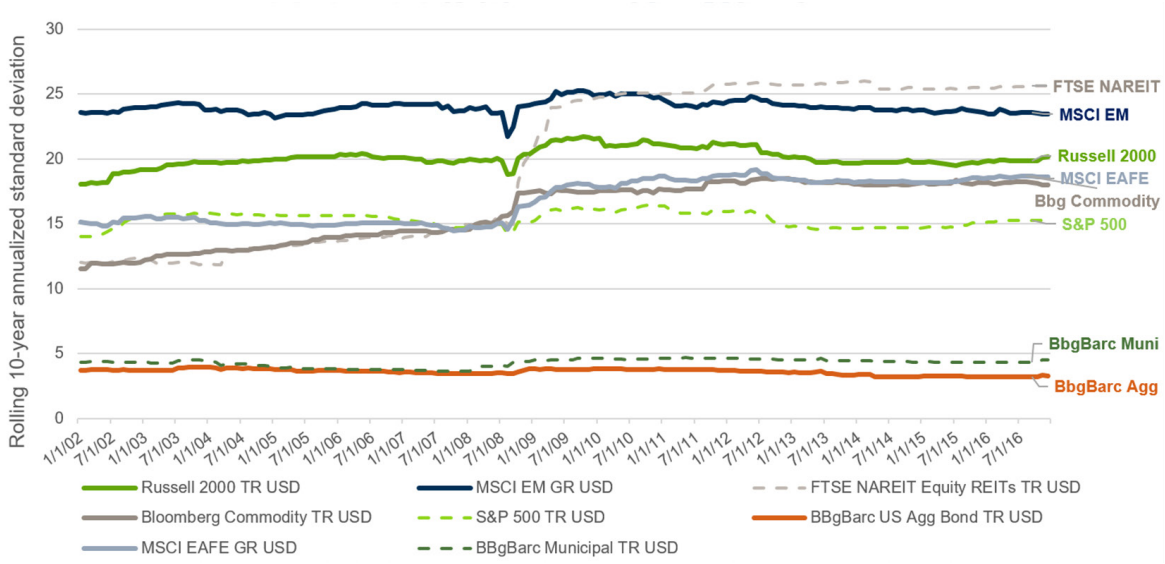
January 1992 – December 2016



Now, the same asset classes are looked at in terms of their 10-year rolling annualized volatilities, as shown below.

Figure 9: Rolling 10-Year Annualized Volatilities (Standard Deviations) by Asset Class

January 1992 – December 2016



The volatility time series in the second chart is noticeably smoother, with a modicum of noticeable drifts ("regime changes"). It is worth noting that, in our analysis of index data going back to 1926, we noticed a higher level of volatility in the 1926–1988 time period vs. post-1988. In our opinion, this reflects a regime shift that, as a result of more transparent and liquid markets post-1988, generally has resulted in less volatility in today's markets. As a result, 1st Global focused on the post-1988 data for the purpose of helping to shape our forward-looking asset class volatility estimates.

That being said, a significant volatility regime shift post-1988 occurred in the real estate securities (or REITs) asset class (the grey line in the preceding graph). REITS, as proxied by the FTSE NAREIT Equity REITs TR USD Index, experienced a dramatic upward shift in volatility — noticeably more than other asset classes during the financial crisis of 2007–2008. When looking at three-, five- and seven-year rolling volatility, though, it was evident that REITs have begun to revert to pre-crisis levels. Thus, we adopted an exponentially weighted moving average (EWMA) approach to account for this distinction.[24]

We also want to point out that we have a strong opinion that historical fixed-income volatility is too low; therefore, we feel that a different estimation is in order for that asset class. An EWMA approach would not be appropriate because it would overweight the most recent periods, which would markedly understate volatility. Instead, we feel that relying on the median estimate of respondents from the Horizon Actuarial Survey was appropriate because most of these surveyed firms have built in expectations of rising rates and would, therefore, be more "pessimistic" on bond volatility in the next 10-year investment horizon. This median estimate of 5.6 is higher than the historical volatility over the common history. Table 6 on the next page summarizes our views on asset class volatilities.

[24] *See Appendix for more about EWMA.*

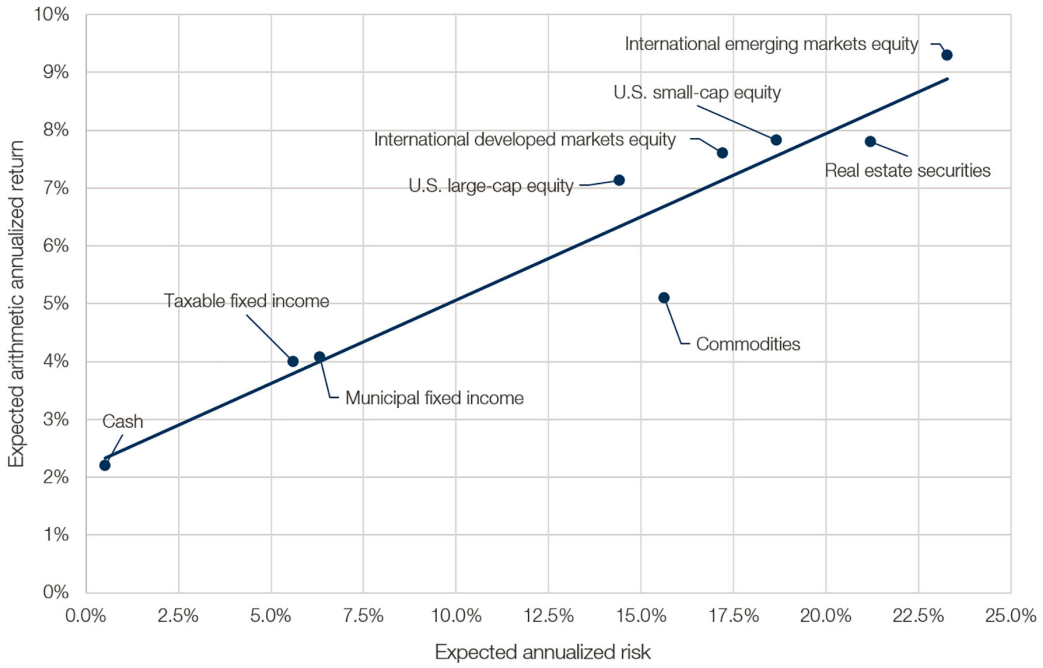
Table 6: Expected Asset Class Risk

	Cash	Taxable Fixed Income	Municipal Fixed Income	U.S. Large-Cap Equity	U.S. Small-Cap Equity	International Developed Markets Equity	International Emerging Markets Equity	Real Estate Securities	Commodities
Expected volatility*	0.52	5.6	6.32	14.43	18.66	17.21	23.27	21.2	15.63

Source: 1st Global Advisors, Inc. as of August 2016.
**Annualized standard deviation. These capital market assumptions/expectations are subject to change. While historical information has been used in part as the input to generate standard deviation and correlation assumptions, past performance may not reflect and does not guarantee future performance.*

When the expected return and expected volatility (standard deviation) are combined, they generally display a pattern in which higher volatilities are correlated with higher returns. To visualize this relationship between risk and return with each of the asset classes based on our estimates, examine Figure 10 below (an "ordinary least squares" regression line is provided to see the linear relationship more clearly).

Figure 10: Asset Class Expected Return and Risk



Source: 1st Global Advisors, Inc. as of August 2016.
These capital market assumptions/expectations are subject to change. The estimated expected returns are forward-looking projections based on our firm's research and a survey of forecasts from outside investment firms. While historical information has been used in part as the input to generate standard deviation and correlation assumptions, past performance may not reflect and does not guarantee future performance. Estimated expected returns should not be construed as projecting or predicting actual returns of any specific investments.

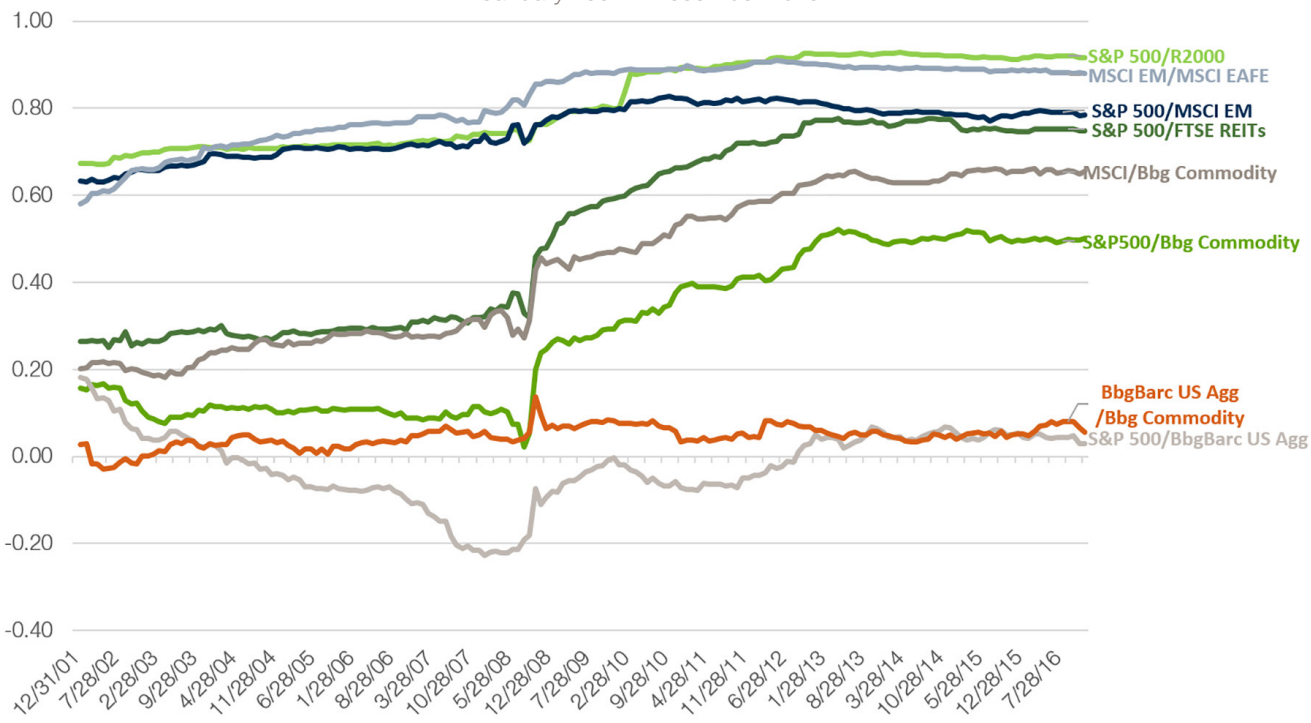
In reviewing Figure 10, you will notice that commodities is the only asset class that falls outside of the linear risk-and-return relationship seen from the other asset classes included in our analysis. This does not represent an error. The exercise of graphing risk-and-return relationships in this manner allows us to re-evaluate and reconfirm our belief that commodities are included primarily for portfolio-level risk-reduction benefits provided by that asset class' low correlation to some of the other asset classes. Commodities are not necessarily in place to enhance portfolio returns.

Asset Class Relationship Expectations

The understanding of the risks presented by individual asset classes and the relationships between asset classes is crucial in the development of risk-efficient portfolios. The relationships between asset classes is known as correlations. Similar to volatility, correlations between any two pairs of assets tend to be more stable over time than returns. Examine the rolling 10-year correlations for key asset class pairings in the chart below.

Figure 11: Selected Rolling 10-Year Correlations by Asset Class Pairs

January 1992 – December 2016



1st Global conducted extensive analysis on how the asset correlations differed across three distinct regimes. The first is common history (January 1992) through the peak of the "tech bubble" in April 2000. The second regime is the period of the tech bubble peak to the start of the Great Financial Crisis (April 2000 through August 2008), and the third regime is the period from the Great Financial Crisis to the present. Each of these regimes displays some commonality of asset class relationships.

We also looked at the entire historical series to see how it compared to the three underlying regimes mentioned above. Lastly, we carefully examined what the participants of the Horizon Actuarial Survey stated as to their forward-looking beliefs about the asset class correlations. The result of that analysis was that correlations were not meaningfully different when comparing across these dimensions, except for the REIT asset class and the commodity asset class versus all other asset classes. We used an alternative weighting scheme (exponentially weighted moving average)[25] to record correlations for these two asset classes over the common history.

Interestingly, the correlations generated were very similar to many of the survey responses as a cross check. Next, using third-party software, we conducted a mathematical decomposition of the modified matrix to ensure its validity. The conclusion from the decomposition is that we had a valid matrix.

[25] *See Appendix for more about EWMA.*

Table 7: Expected Asset Class Correlations

Correlation Matrix	Cash	Taxable Fixed Income	Municipal Fixed Income	U.S. Large-Cap Equity	U.S. Small-Cap Equity	Intl. Developed Markets Equity	Intl. Emerging Markets Equity	Real Estate Securities	Commodities
Cash	1								
Taxable fixed income	0.17	1							
Municipal fixed income	0.09	0.74	1						
U.S. large-cap equity	0.04	0.14	0.15	1					
U.S. small-cap equity	-0.02	0.02	0.07	0.8	1				
International developed markets equity	-0.03	0.09	0.11	0.73	0.64	1			
International emerging markets equity	0	0.02	0.06	0.66	0.67	0.69	1		
Real estate securities	-0.04	0.28	0.26	0.64	0.67	0.6	0.53	1	
Commodities	0.11	0.01	-0.06	0.42	0.39	0.53	0.59	0.24	1

Source: 1st Global Advisors, Inc. as of August 2016.
These capital market assumptions/expectations are subject to change. The estimated expected returns are forward-looking projections based on our firm's research and a survey of forecasts from outside investment firms. While historical information has been used in part as the input to generate standard deviation and correlation assumptions, past performance may not reflect and does not guarantee future performance. Estimated expected returns should not be construed as projecting or predicting actual returns of any specific investments.

Portfolio Optimization

We have detailed the process used in the development of the inputs necessary for conducting a portfolio optimization: expected returns, expected risk and expected relationships. Having collected the necessary portfolio analysis inputs, we are able to move to the next step in the model development process: portfolio optimization. Portfolio optimization is the computational process of identifying efficient portfolios made up of a specified set of asset classes, given an investor's expectations of return, risk and the relationships between those asset classes. The process separates efficient portfolios from inefficient portfolios with the end result of identifying the efficient frontier, which is the optimal set of portfolios that has the highest expected return for each possible level of risk. While portfolio optimization may seem like a strictly mathematical endeavor, it requires a great deal of professional judgment in its application. Case in point, an optimization without constraints would lead to extreme and poorly diversified portfolios, so before an optimization can be run, well-thought-out constraints must be put in place.

Optimization Constraints

The portfolio optimization process is more than simply computing the logical results of given asset class inputs. Unconstrained optimization output can provide a mathematically correct solution to the problem posed, but the blind acceptance of the output without assessing its real-world implications for investors is not advisable. Indeed, judgment is a critical component in the optimization process. There are factors that are not incorporated into optimization calculations that must be considered before accepting optimization output as an appropriate course for investing. These factors can include estimation errors, return outliers, investor behavior, client objectives, regulatory limitations and tax implications.

Consider, for example, the most aggressive point on an efficient frontier provided by an unconstrained optimizer. This is the point that maximizes expected return and the point of maximum risk. An investor selecting this point would need to be unconcerned with risk and must be willing to accept it at its highest degree. Additionally, this most aggressive point is likely to be made up entirely of the one asset class with the highest return and the highest risk.

The portfolio optimizer should never be viewed as a substitute for professional judgment. Ultimately, the optimization process should consider issues beyond those indicated by risk and return. Constraining the optimizer is one way of addressing these issues. It is in the application of constraints to the optimization process where mathematical logic and professional judgment are combined to create portfolios that may be better suited to investor objectives and behavioral biases.

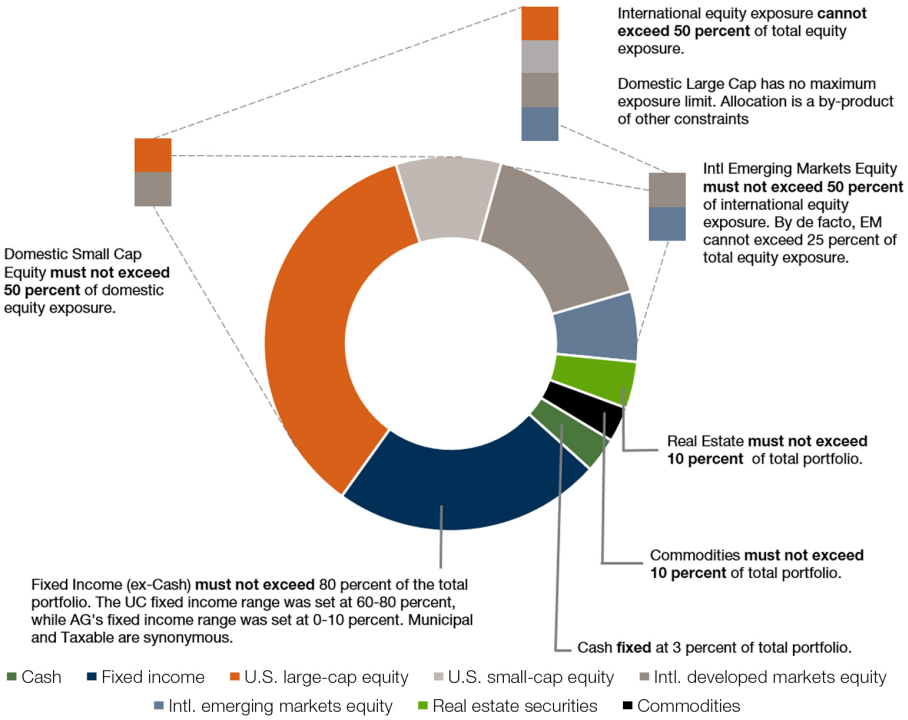
A constraint can be as simple as limiting the amount of an asset class that an optimizer is allowed to incorporate on an absolute basis (e.g., emerging market stocks can be no more than 20 percent of a portfolio). Constraints can be set on a relative basis, as well, such as limiting the amount of one or more asset classes relative to the amount of one or more other asset classes (e.g., international stocks should be less than or equal to 40 percent of all stocks held in a portfolio).

1st Global started off by telling the optimizer that asset classes should be rounded to the nearest percentage point, and the minimum barrier for asset class exposure should be 2 percent. The next step was to establish limits of exposure to the fixed income asset class across the efficient frontier. This is vital in determining the portfolio on the far-left of the frontier where a significant allocation to fixed income is likely. With the fixed-income ranges established, the remainder was distributed between the equity, real estate securities and commodities asset classes. For the equity component, the decision was made to place a group constraint on both domestic and international equity as well as with domestic small-cap equity and international emerging market asset classes. The group constraint allowed the optimizer the ability to weight the equity component according to conviction, but it will inhibit the optimizer from over-allocating this conviction in the model portfolios.

Due to the nature of optimization, we know that it is largely driven by the constraints, and we expected that the behavior of the optimizations would be the classic result: The left side of the efficient frontier is heavy with fixed-income exposure, and the right side is heavy with equities. 1st Global believes it is not enough to look at a constrained optimization and point to optimization mathematics as “proof” of a superior combination of asset classes at a given risk level. As a practical matter, there is a case to be made for enhancing diversification by attempting to access exposures to all asset classes for each risk profile.

The relative and absolute constraints are displayed in Figure 12 on the next page.

Figure 12: Visualization of Optimization Constraints



Source: 1st Global Advisors, Inc. as of August 2016.

Optimization Procedures

The optimization is geared toward a 10-year horizon and is conducted within the Morningstar Direct optimization module. 1st Global examined optimizations from multiple angles and characteristics, including the effects of no constraints and all constraints, historical-only capital market assumptions versus proposed forward-looking assumptions, and by the type of mathematical techniques used. These techniques included assuming different types of statistical return distribution patterns and different types of simulation methods (e.g., differing resampling parameters). 1st Global also compared the effects of portfolio behavior at the left end and right end of the efficient frontier by examining the results of optimizations with differing allocations to fixed income.

Optimization Results

The final component of the model development process is the selection of portfolios from the set of choices provided by the optimization process. We previously discussed how an investor examining an efficient frontier could select a portfolio that maximizes his or her preferences for accepting risk using only risk and return as the basis for his or her decision. We now have an efficient frontier from which to select portfolios.

Depending on how well investors are able to define their preferences for taking risks in the pursuit of returns, the frontier we have identified contains any number of portfolios from which an investor can select. In practice, however, it can be a daunting endeavor for an investor to select from such a broad set of portfolio options. This process can be simplified by identifying a smaller, but differentiated, set of portfolios on the efficient frontier from which investors can select.

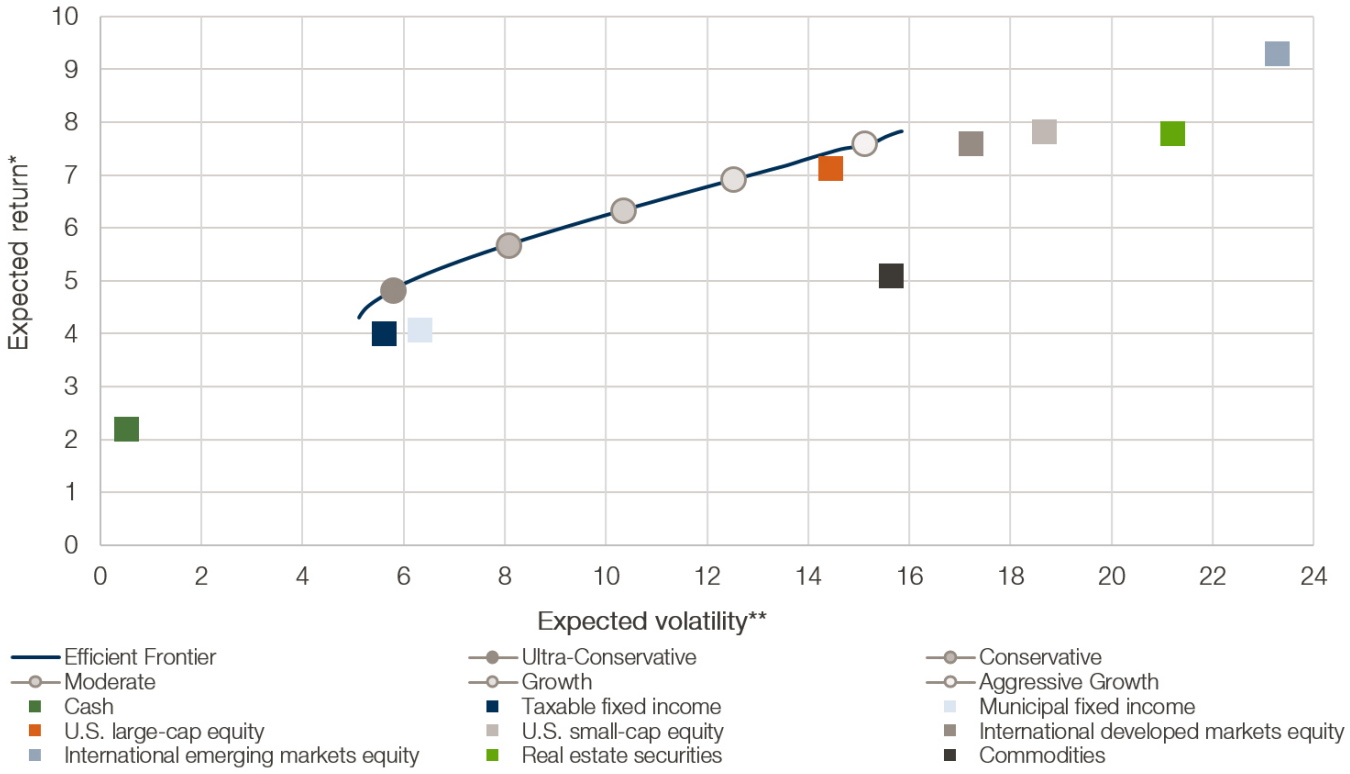
It is important that selected portfolios reflect distinct risk and return characteristics, as it is on those two factors that investors will base their investment decisions. 1st Global has elected to identify five portfolios to represent five distinct risk profiles from which advisors and clients can select. The portfolios were selected based on judgment regarding composition as well as risk and return characteristics. The five specific risk profiles are Ultra-Conservative, Conservative, Moderate, Growth and Aggressive Growth.

There were two main areas of consideration when setting the endpoints; the amount of fixed income in each risk profile (as discussed earlier, fixed income is assumed the linchpin of diversification due to its low correlations with nearly every other asset class) and considerations regarding the distance between the five risk profiles, as measured by standard deviation. The decision to divide the five risk models equally based on standard deviation ensures equal scaling as investors move through risk profiles based on changes in timeframes and/or risk tolerances as well as a data-driven asset allocation outcome. With the method of scaling in place, focus was directed on setting the endpoints on the efficient frontier.

Starting with the left endpoint, we established the fixed-income allocation in the Ultra-Conservative risk profile of 70 percent as an anchor. In addition to fixed-income exposure, focus was on including as many asset classes as made possible by the optimization output. A 70-percent fixed-income allocation allows for the inclusion of domestic small-cap and international emerging market stocks in the Ultra-Conservative risk profile. The same considerations for setting the left endpoint were applied when determining the right end point, namely the inclusion of the maximum amount of asset classes and the impact on the fixed-income asset class allocation in the Conservative, Moderate and Growth risk profiles.

The final output of the optimization process is the identification of the efficient frontier that is based on our beliefs and convictions about the future and that addresses the needs and concerns incorporated into the analysis. 1st Global's final efficient frontier is shown as Figure 13 below.

Figure 13: Expected Efficient Frontier — Model Portfolios and Asset Class



Source: 1st Global Advisors, Inc. as of August 2016
**Asset class expected returns are shown as arithmetic forward-looking annual returns for the next 10-year time horizon.*
***Asset class standard deviation is shown as expected annualized standard deviation.*
Past performance is not a guarantee of future results. The values shown are estimates and not a guarantee or warranty of future asset class or model portfolio performance or associated risk. They are not the actual performance for any of the firm's clients.

We began this paper with the fundamental reality that the future is unknown. We then detailed the development of the necessary inputs for MPT analysis. These efforts resulted in specific expectations for returns, standard deviations and asset class correlations. However, the unknown is not likely to be so precise. If we accept the notion that the future is uncertain, we must also accept the idea that, despite the efforts put forth in deriving expectations, it is unlikely that future outcomes will precisely match those estimates. One way of accounting for the inevitable uncertainty in forward-looking expectations is to use a process called resampling, which deals with this uncertainty by incorporating simulated outcomes into the optimization process. These simulations are based on the information provided by our derived asset class assumptions.

While our assumptions may provide specific information, it should be understood that they define our expectations about the future, on average. Return assumptions express what we expect an asset class to return, on average, not necessarily the return we expect in any particular year. Risk assumptions tell us how far, on average, returns can be expected to deviate from the asset class' expected average return. Correlation expectations then provide the information regarding how asset classes act, on average, in relation to one another. Resampling uses this information to generate numerous sets of simulated asset class outcomes. Those outcomes are then used to determine asset class inputs (returns, standard deviations and correlations) that are then optimized to generate efficient frontiers specific to each set of outcomes. Conceptually, each simulation can be viewed as one possible outcome. This process is repeated multiple times to generate multiple efficient frontiers. Frontiers generated from the sets of simulated outcomes are then averaged to create a final efficient frontier known as the resampled efficient frontier, which is ultimately the result of incorporating multiple possible outcomes that are all a function of our original asset class expectations.

In the process of generating our final resampled efficient frontier, 1,000 efficient frontiers were generated using 1,000 sets of 60 period (month) simulations for each of the asset classes selected to be included within 1st Global model portfolios. The number of periods simulated can be viewed as a natural parameter for expressing confidence in the accuracy of risk and return estimates. The lower the number of simulated data points, the lower the confidence.[26] While 1st Global's use of 10-year inputs might indicate the use of 120 simulated periods, we opted for the use of 60 simulated periods in the resampling process. This decision is not intended as an expression of confidence in the accuracy of the derived inputs but, rather, a method of aligning the resampling process with 1st Global's policy of reviewing asset allocation inputs annually and formally reviewing models on a five-year interval (or every 60 months). This approach incorporates information about the uncertainty regarding five-year outcomes that is indicated by our asset class expectations.

[26] *Michaud, R.O. and R.O. Michaud. Efficient Asset Management. New York, New York: Oxford University Press, 2008.*
[27] *Markowitz, H.M. Portfolio Selection: Efficient Diversification of Investments. Malden, Massachusetts: Blackwell Publishers, 1991.*

Portfolio Selection

1st Global's Asset Allocation Models

We have progressed through the MPT process of identifying efficient portfolios, beginning with the selection of asset classes, continuing through the development of expectations based on beliefs to the optimization process, and concluding by identifying a specific set of model portfolios. As Markowitz explains, "The results of a portfolio analysis are no more than the logical consequences of its information concerning securities."[27] Table 8 provides the logical conclusion of our efforts and provides specific asset class weightings, the expected return and the expected risk for each of the distinct portfolios.

Table 8: 1st Global's Model Portfolios[28]

Asset Class	Ultra-Conservative	Conservative	Moderate	Growth	Aggressive Growth
Cash	3%	3%	3%	3%	3%
Fixed income	70%	47%	29%	13%	-
U.S. large-cap equity	11%	22%	31%	39%	30%
U.S. small-cap equity	5%	8%	11%	13%	30%
International developed markets equity	5%	10%	13%	17%	17%
International emerging markets equity	2%	4%	6%	8%	14%
Real estate securities	0%	3%	4%	4%	4%
Commodities	4%	3%	3%	3%	2%
	100%	**100%**	**100%**	**100%**	**100%**
Expected return (arithmetic mean)	4.81%	5.67%	6.32%	6.91%	7.5%
Expected risk (standard deviation)	5.79%	8.09%	10.35%	12.53%	15.11%

Source: 1st Global Advisors, Inc.
**Arithmetic annual returns — forward-looking 10-year time horizon*
***Annualized standard deviation*
Past performance is not a guarantee of future results. The values shown are estimates and not a guarantee or warranty of future asset class or model portfolio performance or associated risk. They are not the actual performance for any of the firm's clients.

[28] *Models instituted Aug. 24, 2016.*

III. Practice

Evaluation of 1st Global Model Characteristics

Updated January 2017

Now that specific model portfolios have been identified, we are able to evaluate the risk and return characteristics of the model portfolios using historical data. Rather than simply reviewing trailing time period returns, we believe it is more useful to understand the characteristics of the portfolios over rolling five-year holding periods. This approach avoids the endpoint bias that is often misleading with trailing statistics. It also provides a sense for how portfolios acted in different market environments. A five-year holding period is suitable for evaluation purposes, as it provides adequate time for asset classes to demonstrate their diversification characteristics.

The analysis assumed that portfolios were rebalanced annually. Beginning January 1992, five-year (60-month) periods were identified by moving forward monthly. Each month began a new 60-month holding period. In all, there were 241 five-year holding periods within the available data set. Five-year risk and return was calculated for each period available. Holding period risks and returns for asset classes included in model portfolios were also calculated.

We evaluated the risk characteristics of the five model portfolios to determine if they exhibited distinct risk profiles over different time periods. Figure 14 shows that portfolios demonstrated risk that was commensurate with the degree of equity risk within each of the models.

Figure 14: Rolling Five-Year Holding Period Risk for 1st Global Model Portfolios

241 Five-Year Holding Periods between January 1992 — December 2016

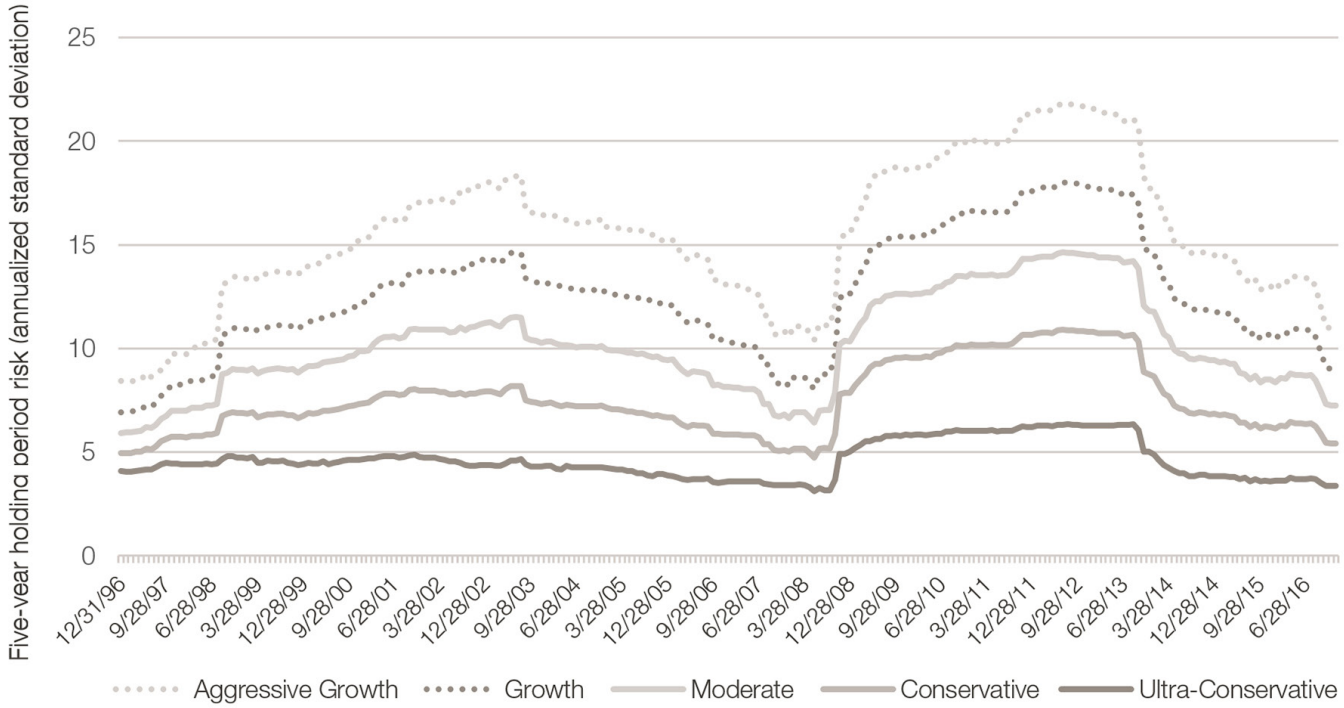


Table 9 provides summary information for model portfolio five-year return outcomes. The portfolio return outcomes show that model portfolios provided, on average, returns that were scaled according to risk profiles. Portfolios that are more aggressive achieved higher five-year returns, on average, than more conservative portfolios. The range of return outcomes (the difference between highest and lowest) demonstrated by different portfolio models matched expectations in that outcomes were narrower for portfolios that are more conservative and wider for portfolios that are more aggressive. This difference in the variability of portfolio outcomes illustrates what risk, in terms of standard deviation, can mean to investors. As investors select more aggressive portfolios, investment outcomes become less predictable. Another element of portfolio risk that is important to investors is the possibility of experiencing negative returns. Characteristics between model portfolios also showed that outcomes matched risk profiles. Portfolios that are more aggressive demonstrated greater likelihood of experiencing negative five-year returns than more conservative portfolios.

Table 9: Summary of Annualized Rolling Five-Year Holding Period Returns for 1st Global Model Portfolios

241 Five-Year Holding Periods between January 1992 – December 2016

	Ultra-Conservative	Conservative	Moderate	Growth	Aggressive Growth
Highest return	10.56%	13.48%	16.5%	19.1%	21.85%
Lowest return	1.9%	0.09%	-1.52%	-2.97%	-3.89%
Average return	6.57%	7.46%	7.9%	8.12%	8.34%
Average volatility	4.61%	7.53%	10.15%	12.59%	15.52%
Number of positive returns	241	241	239	233	226
Number of negative returns	0	0	2	8	15

Past performance does not guarantee future results.

Table 10 provides summary information of five-year return outcomes for the asset classes included in 1st Global's model portfolios. A comparison of five-year return outcomes for model portfolios and the asset classes that make up those portfolios provides some very pertinent information regarding the benefits of efficient diversification, specifically in terms of experiencing negative returns. These outcomes show that asset classes experienced negative returns much more frequently than model portfolios.

Table 10: Summary of Annualized Rolling Five-Year Holding Period Returns for Selected Asset Classes

241 Five-Year Holding Periods between January 1992 – December 2016

	Cash	Fixed Income	U.S. Large-Cap Equity	U.S. Small-Cap Equity	Intl. Developed Markets Equity	Intl.Emerging Markets Equity	Real Estate Securities	Commodities
Highest return	5.35%	8.06%	27.87%	24.31%	23.71%	39.11%	28.20%	18.36%
Lowest return	0.05%	2.23%	-6.63%	-6.68%	-6.88%	-10.19%	-8.64%	-14.44%
Average return	2.81%	5.96%	9.04%	8.92%	5.66%	7.20%	11.13%	3.87%
Average volatility	0.33%	3.56%	14.84%	19.47%	16.42%	23.23%	18.56%	15.04%
Number of positive returns	241	241	192	221	190	169	223	162
Number of negative returns	0	0	49	20	51	72	18	79

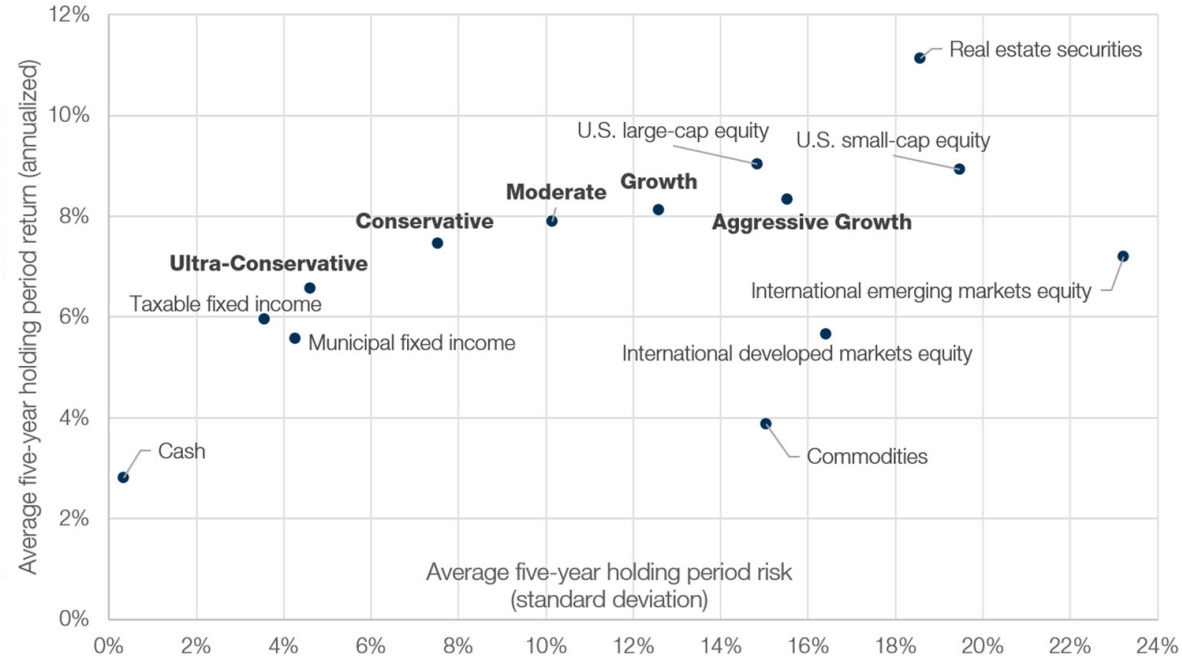
Past performance does not guarantee future results.

These two tables illustrate a key point that investors should understand: Holding efficiently diversified portfolios does not mean that the individual parts of the portfolio are less likely to experience losses. The summary data shows that the asset classes do experience losses. It is only when these assets classes are taken together, as a portfolio, that diversification benefits become evident. It is often in the efforts to move away from losses that investors deviate from efficient implementation by shifting assets to areas that performed well in the recent past. This can increase portfolio risk by reducing the diversification benefits provided by investments that were intended to perform differently than others in the portfolio.

A final view of the results of our analysis provides additional insights as to the benefits of efficiently diversified portfolios. Figure 15 provides a graphical summary of the average five-year risk and return outcomes for model portfolios and the asset classes included in 1st Global's model portfolios. What is evident from this chart is that model portfolios, on average, provided returns commensurate with their equity allocations at risk levels below many of the equity asset classes included in the portfolios.

Figure 15: Average of Annualized Five-Year Holding Period Risk and Return for 1st Global Model Portfolios and Select Asset Classes

241 Five-Year Holding Periods between January 1992 – December 2016



Past performance is no guarantee of future results. The chart above is for informational purposes only and does not predict the future performance of any investment. The results indicated above were calculated by means of the retroactive application of the static blend of asset class indices indicated by each of 1st Global's model portfolios rebalanced annually at calendar year end. The information compiled cannot be considered an indication of the investment ability of 1st Global Advisors, Inc. and does not result from actual investment decisions by the firm. The investment results of 1st Global Advisors, Inc. clients may be materially different from the results portrayed in the models. THESE RESULTS ARE NOT THE ACTUAL PERFORMANCE FIGURES FOR ANY OF THE FIRM'S CLIENTS, AND IT SHOULD NOT BE ASSUMED THAT RECOMMENDATIONS MADE IN THE FUTURE WOULD BE PROFITABLE. The figures above do not take tax effects into consideration. These results do not represent actual trading and do not reflect the impact that material economic and market factors might have had on the firm's decision making if the firm were managing a client's money. The client's own objectives, risk tolerance and financial circumstances may change over time, causing a change in the investment allocation that is used to manage that particular client's portfolio. Each of the allocation models above represents one possible asset allocation strategy, and other strategies may have performed better or worse than the portfolios above over the same time period.

This analysis allows for a better understanding of the risk and return characteristics of 1st Global's model portfolios. In the context of historical return data, model portfolios corresponding to specific risk profiles provided distinct risk and return characteristics that were maintained through multiple five-year holding periods that included a variety of market environments. Additionally, it has served to illustrate some key risk concepts, set investor expectations for portfolio constituents and highlight the benefits of efficiently diversified portfolios.

Conclusion

1st Global continues its commitment to providing sound investment guidance firmly based on rigorous academic and intellectual standards. This commitment is demonstrated in our efforts to improve the tools and resources that enable clients to honor the important promises they make. 1st Global's model portfolios represent but one of these resources. Beyond merely providing a set of portfolios, we have sought to share the philosophical, mathematical and practical concepts that are the foundation of MPT so that investors can make the best use of them in practice.

Disclosures

Investing in bonds and other fixed-income securities involves special risks, including credit risk, which is the risk of potential loss due to the inability to meet contractual debt obligations, and interest rate risk, which is the risk that an investment's value will fluctuate due to a change in the level of interest rates. There is an inverse relationship between bond prices and interest rates specific to fixed-income securities. As interest rates rise, bond prices fall, and as interest rates fall, bond prices rise.

Small-cap and microcap stocks may involve risks not associated with investing in more established companies and can be highly speculative. These stocks may be more volatile because they may be less liquid or financially secure, and their product lines are not as diverse.

International investing has certain risks not associated with investing solely in the U.S. These risks include fluctuations in the value of the U.S. dollar relative to other currencies, custody arrangements made for foreign holdings, political risks, differences in accounting and the amount of information disclosed by non-U.S. exchange-listed companies.

Investing in emerging markets involves greater risks, as well. Such risks include currency exchange rates, political and economic upheaval, lack of information about companies, poor liquidity, and differences in accounting standards.

An investment in commodity-linked derivative instruments may be more volatile than traditional securities and may not be suitable for all investors.

The Bloomberg Barclays US Treasury Bill 1–3 Month TR Index is an unweighted index that measures the performance of one-month to three-month maturity U.S. Treasury bills.

The Bloomberg Barclays Aggregate Bond TR Index covers the U.S. investment-grade fixed-rate bond markets, with index components for government and corporate securities, mortgage pass-through securities, and asset-backed securities.

The S&P 500 TR Index is a free-float market capitalization index of 500 large publicly held U.S.-based companies, capturing 75 percent coverage of U.S. equities. It is often used as a proxy for the American stock market.

The Russell 2000 TR Index measures the performance of the smallest 2,000 companies in the Russell 3000 Index and serves as a benchmark for U.S. small-cap stocks.

The MSCI EAFE GR Index (Europe, Australasia, and Far East) is a free-float adjusted market capitalization index that is designed to measure the equity performance of 22 developed markets, excluding the U.S. and Canada. The MSCI EAFE Index is commonly used as a benchmark for equities representing the developed world outside of North America.

The MSCI Emerging Markets GR Index is a free-float adjusted market capitalization index that is designed to measure equity performance in the global emerging markets.

The FTSE NAREIT Equity REIT TR Index includes all equity REITs trading on the NYSE Euronext and the NASDAQ OMX. Equity REITs are defined as those firms that own, manage and lease investment-grade commercial real estate.

The Bloomberg Commodity TR Index is a diversified benchmark for commodities and is composed of futures contracts on physical commodities. It uses both liquidity data and U.S.-dollar-weighted production data in determining the relative quantities of included commodities. No related group of commodities (e.g., energy, precious metals, livestock or grains) may constitute more than 33 percent of the index.

The indices illustrated in this paper are unmanaged indices of common stocks, bonds or other securities. The volatility of the indices may be materially different from the individual performance attained by a specific investor. In addition, an investor's holdings may differ significantly from the securities that constitute the indices. It is not possible to invest directly in an index.

The returns of the actual investments selected as part of your portfolio will vary. Before investing in any mutual fund, investors should carefully consider a fund's investment objectives, risks, charges and expenses. Fund prospectuses contain this and other information and may be obtained from your financial advisor. Neither asset allocation nor diversification will protect an investor in falling markets.

These capital market assumptions/expectations shown in this document are subject to change. The estimated expected returns are forward-looking projections based on our firm's research and a survey of forecasts from outside investment firms. While historical information has been used in part as the input to generate standard deviation and correlation assumptions, past performance may not reflect and does not guarantee future performance. Estimated expected returns should not be construed as projecting or predicting actual returns of any specific investments.

Past performance is no guarantee of future results.

Neither asset allocation nor diversification assures a profit or protects against a loss in declining markets.

Investments are subject to market risks including the potential loss of principal invested.

Appendix

Horizon Actuarial Survey

Horizon Actuarial is a well-known consulting firm specializing in providing actuarial solutions to multiemployer benefit plans. The list of respondents for the 2015 survey (referred to earlier as the "Horizon Survey") are listed below.

- AJ Gallagher
- Marco Consulting
- RV Kuhns
- Alan Biller
- Marquette
- Segal RogersCasey
- Aon Hewitt
- Meketa Group
- SEI
- Bank of New York
- Merrill Lynch
- Sellwood
- Bogdahn Group
- Morgan Stanley
- Towers Watson
- Callan Associates
- NEPC
- UBS
- CapTrust
- Pavilion Advisory
- Verus (Wurts & Associates)
- Envestnet
- Pension Consulting Alliance
- Voya
- Graystone
- PFM Group
- Wells Fargo

Description of EWMA Approach

In several instances in this recommendation memo, an exponentially weighted moving average (EWMA) approach was advocated for certain asset class parameters in which either the historical statistic or the use of survey results provided challenges. The EWMA approach is well-known in risk management circles, and the methodology's usage was popularized by J.P. Morgan's original RiskMetrics software. Outside of assessing asset risk to banks, the theoretical and philosophical underpinnings of the approach make it a very useful tool to use when one wants to incorporate the full raft of historical data but believes that conditions going forward are more likely to be like recent periods rather than periods further back in time. Unlike rolling periods or regime analysis, the method retains the "echoes of periods past" in the results.