Engineering Targeted Returns and Risks

How to structure a portfolio to target a 10% return with 10-12% risk

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BRIDGEWATER

In 1996, Bridgewater Associates established the All Weather principles for asset allocation, which have now been more broadly adopted under the banner "Risk Parity." In 2004, Mr. Dalio wrote an article in which he explained these principles. That article is reprinted here, with relevant updates.

In the drive to solve their two biggest problems—inadequate expected returns and over concentration in equities—institutional investors are increasingly asking how they can engineer portfolios to realize specified return and risk targets. As a result, interest in financial engineering has recently accelerated.

This article outlines the approach we at Bridgewater Associates use to engineer portfolios. In it, we break down returns into a few basic building blocks, discuss these building blocks and describe how they can fit together. Since there are only a few building blocks, which are easily understood, and because these blocks can fit together in limited ways, our approach to financial engineering is straightforward and can be explained in just a few pages.

What this article cannot do, given the limitations of space, is describe the substantial amount of research we have performed to stress-test these concepts and the various nuts-and-bolts steps you can take to implement them. I ask you to focus on the principles first, and then drill down later should you find the concepts worthy of further consideration.

For lack of a better term, I will call the engineering process described in this article **Post-Modern Portfolio Theory (PMPT)** because it builds on the concepts of portfolio theory, and then goes a few steps beyond. The traditional application of Modern Portfolio Theory (MPT) first combines asset classes based on their expected returns, risks and correlations, and once the asset allocation mix is determined, identifies the best managers in each asset class. By contrast, PMPT differs in three key ways: first, returns from alpha and beta are separated; second, the sizes of alpha and beta are altered to more desirable levels; and finally, far more diversified portfolios of each are derived. As a result, a PMPT portfolio will not only have returns and risks that are more calibrated to suit the investor's objectives, but also will be much more diversified than the traditional portfolio.

Basic Building Blocks

Let's assume you want to engineer a portfolio with a targeted return of 10% and you want to do this with the lowest possible risk. What are your options? Since the returns of your portfolio will be equal to the weighted average of the return streams that comprise it, you will have to decide on a mix of return streams that will average 10%. The three basic building blocks of all returns are:

- **The Risk-Free Return**—Generally the return on cash, although the risk-free return should be whatever rate best neutralizes your risks (for example, investors seeking real returns should use the return on inflation-indexed bonds).
- **Returns From Betas**—The excess returns of asset classes over the risk-free return. For example, if the risk-free return is 2% and the expected return of equities is 7%, the expected beta of equities is 5%. The total return of an indexed portfolio of stocks can be broken down into the risk-free return and the beta.
- **Returns From Alphas**—The value added by managers, which is derived from managers deviating from the betas.

Please note that this article doesn't refer to products or services, but rather to the concepts and principles relevant to engineering portfolios for institutional investors.

Since total returns equal the sum of these three building blocks, and your portfolio's return will equal the sum of these, the first step in engineering a portfolio to achieve your targeted return is to decide how much of the excess return should come from betas and how much should come from alphas. This is not a question that can be answered quantitatively. Instead, it is more philosophical, because although betas and alphas both provide return streams, they are very different.

Betas are limited in number (that is, not many viable asset classes exist), they are typically relatively correlated with each other, and their excess returns are relatively low compared to their excess risks, with Sharpe ratios typically ranging from 0.2 to 0.3. However, betas are reliable—we can expect they will outperform cash over long time horizons.

Alphas, on the other hand, are different. Sources of alpha are numerous and relatively uncorrelated with each other. However, their returns are unreliable, with risk-adjusted returns slightly negative on average, even over long time periods. The expected returns of alpha are slightly negative in aggregate for two reasons: First, adding value is a zero-sum proposition—for one manager to add value, another one must lose. Second, there are transaction costs and fees. The range of risk-adjusted returns around this slight negative average is enormous because, in this zero-sum game, exceptional managers can produce excellent alphas while poor managers can have very negative ones. Thus the rewards or penalties from choosing managers and balancing alphas are very large. And unlike the returns from betas—where you can be fairly confident returns will be positive over time regardless of which betas you choose—returns from alphas will be negative if you do not choose wisely. If you select alphas well, however, you can create a much better portfolio of them than of betas because you have many more, less correlated, more attractive return streams to combine into an efficient portfolio.

In order to achieve a targeted return (to use our example, 10% annually) that is higher than the return than can be locked in via market pricing (say, 5%), the investor must take some risk. The question then becomes, which risks are you most comfortable taking? If you are comfortable taking beta risk and uncomfortable taking alpha risk because you are not confident in your ability to pick active managers that will add value, you may decide to engineer your portfolio to only have beta risk. In this case, you will have to engineer a beta portfolio to provide 100% of your 10% targeted return. Alternatively, if you believe you can select managers who can add value, you may instead choose to engineer an alpha portfolio to produce 100% of your targeted return.

Most investors have backed into a mix dominated by betas, especially equities. Because the money allocated to an asset class typically determines the type of active manager chosen, the heavy commitment to equities typically results in alpha being dominated by equity managers. Therefore, the portfolio derived via a traditional approach typically exhibits much greater beta risk than alpha risk (generally about 95%/5%), its overall beta is dominated by equities (that is, the typical pension fund is 95% correlated with equities) and its alpha is dominated by equity managers. This is anything but a diversified portfolio.

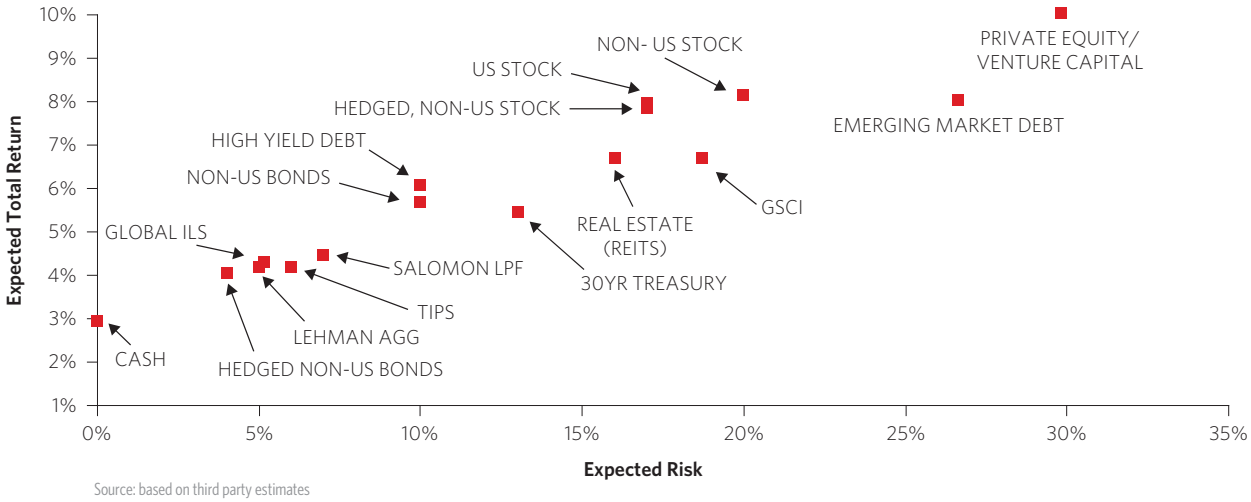
In the PMPT approach, this mix of beta and alpha is explicitly chosen, and both the beta and the alpha portfolios are much better diversified. Although there is no "right" mix between beta and alpha, we believe we will see—indeed, we are seeing—a significant shift increasing alpha's share. However, since we know alpha is zero-sum, choosing more alpha will not necessarily increase returns; in fact, for approximately half the population, it will lower returns. I am confident that managers who are smart at finding and balancing alphas will be in great demand in years ahead, and those who can identify managers capable of generating positive alphas and balance those alphas well will produce extremely powerful results. In any case, the disparity of results in alpha portfolios will be enormous. I also believe, for reasons I will explain later, that good managers' alphas will improve because investors will increasingly allow them to balance their bets better.

In the next two sections, I explain how we construct Optimal Beta and Optimal Alpha portfolios. I want to emphasize that I am offering a menu of options; you are free to choose some and reject others.

The Optimal Beta Portfolio

Perhaps the investment assumption in which a majority of investors are most confident about is that betas, or asset classes, will outperform cash over time. There are two reasons for this: first, the capitalist system is based on this assumption, since the central bank creates cash, and those who have good uses for cash will borrow and use it to achieve a higher return; and second, investors want to be compensated for risk. Chart 1 illustrates one consultant's expected risks and returns of various asset classes.

Chart 1: Expected Return/Risk Levels for Various Asset Classes



Source: based on third party estimates
Past results are not necessarily indicative of future results.

While everyone's expectations are a bit different, most investors assume that riskier assets generally have higher expected returns. I believe that this relationship exists because assets can be made "competitive" with each other and "arbitraged" through the use of leverage. In other words, by borrowing cash to buy more of an investment, one can raise both the expected return and the expected risk of that investment. For example, through the use of leverage, bonds can be made "competitive" with equities. Rather than being theoretical, leveraging is constantly affecting the returns of asset classes. For example, most higher returning, higher risk asset classes, such as equities, private equity, venture capital and real estate, have higher risks and returns because of their imbedded leverage, the leverage that exists within the security. For example, the average debt to equity ratio of companies in the S&P 500 is about 1:1, which raises their returns and risks.

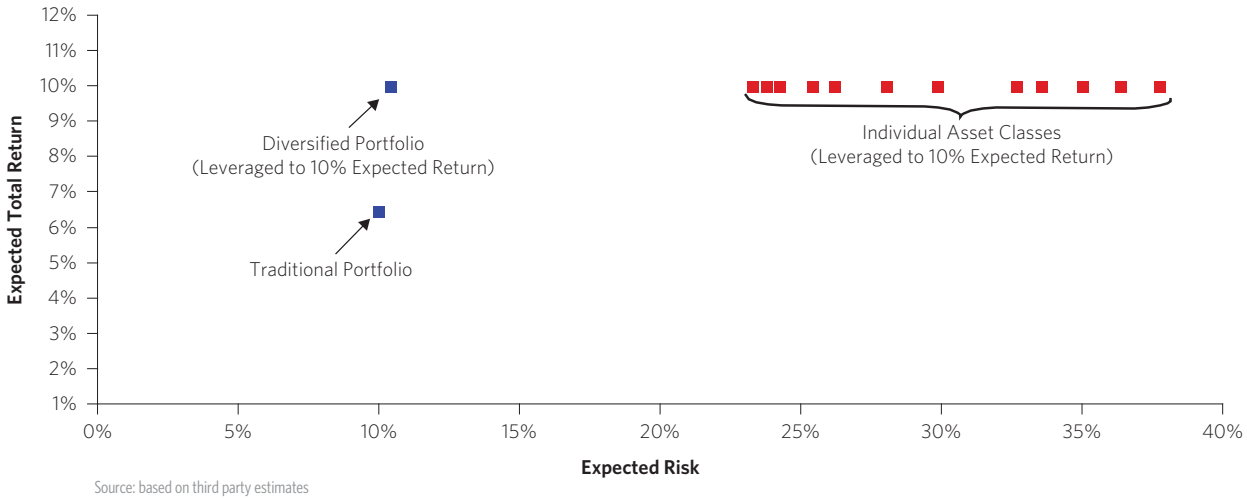
Because the expected returns and risks of asset classes resemble those shown in Chart 1, investors seeking higher returns tend to buy as much of the high-returning asset classes (particularly equities) as they can stand, and then sprinkle in some of the other assets (mostly bonds) for diversification. In our example of trying to come up with a portfolio that has an expected return of 10%, if we follow the traditional path, we would be forced to buy assets that are in the upper right portion of Chart 1, with expected returns that average about 10% per year. As a result, our portfolio would not be diversified. So, we would have to bet an awful lot on one or two asset classes to deliver the desired 10% returns in the time frame that is acceptable to us. Alternatively, we could follow the traditional asset allocation process that would result in our having a slightly more diversified portfolio, with quite a bit of equities and some bonds, that would have an expected return that is significantly below our target. Personally, either of these approaches would make me very uncomfortable.

However, since the risk-adjusted returns of asset classes are broadly similar[1] (and not reliably known), and since their expected returns are greater than that of cash, the expected returns and risks of these asset classes can be made similar and adjusted to deliver returns closer to your target by using leverage or leverage-like techniques. For example, lower returning asset classes can be leveraged to have the same expected return and

[1] Betas have had, and are expected to have, ratios of excess returns to excess risks (Sharpe ratios) of about .2 to .3. That is because a) there needs to be some extra return to compensate investors for excess risk (so this ratio should be positive), but b) this ratio cannot be very positive because that would make these investments attract substantial amounts of capital that would bid up their prices and lower their expected return.

risk as equities or, with a bit more leverage, the 10% target. Chart 2 shows the expected returns and risks of the same asset classes shown in Chart 1, but leveraged to produce expected returns of 10%. Employing leverage in this way gives you many high-returning and high-risk asset classes with which you can construct a portfolio. Imagine how different your portfolio's asset allocation mix would be if Chart 2, rather than Chart 1, reflected your choices. Since in Chart 2's case there are many asset classes that have expected returns of 10%, you could create a much more diversified portfolio that has an expected return of 10%. In Chart 2, we show a diversified portfolio of the leveraged assets and the traditionally structured portfolio, as well as individual asset classes leveraged to a 10% expected return (based on the information shown in Chart 1). As conveyed, the diversified "optimal beta portfolio" has a 10% expected return compared with the traditional portfolio's 6.5% return, while the risks of these two portfolios are about the same. This is not theoretical—leveraged asset classes can be structured in this way and thus offer you choices such as the two portfolios shown in Chart 2 (in blue).

Chart 2: Expected Return/Risk Levels for Various Asset Classes and Portfolios



Source: based on third party estimates
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This concept—that most asset classes can be levered to produce similar and higher targeted returns and risks so that you can create a well-diversified portfolio with expected returns that are consistent with your objectives—requires you only to believe that the expected returns of the asset classes chosen are above cash. If this is the case, then you know that the expected excess returns and risks of these asset classes can be raised through leverage. Once you realize you have this ability, then you can decide how you want to employ it. No longer must you accept the risks and returns of asset classes as they come pre-packaged in Chart 1.

Once you choose asset classes adjusted to have similar returns and risks, the main difference among these asset classes will be their correlations. If we leverage all asset classes to have expected returns similar to equities, a diversified portfolio of these assets will have an expected return that is similar to equities, but with much less risk than either equities or a typical portfolio that is a skewed mix of equities and other investments. Because all of the investments are adjusted to have the same expected return as equities, they diversify each other much better than the "typical portfolio" (which has a lower expected return than equities because it contains lower returning assets and also has more risk because it is highly concentrated in equities).

What this process has done is eliminate the traditional trade-off between risk and return conveyed in Chart 1, which has driven you to concentrate so much of your portfolio in equities. It has also allowed you to create a diversified portfolio of assets with targeted returns consistent with your objectives.

Following a traditional approach, a portfolio combining asset classes that individually have Sharpe ratios of 0.2 to 0.3 typically yields a portfolio Sharpe ratio of about 0.4, with expected returns that are lower than equities. Typically, these traditional portfolios are also about 95% correlated to the equity markets because most of the money is invested in equities and the volatility of equities is much larger than the volatility of the other asset classes. By combining the repackaged assets that have Sharpe ratios of 0.2 to 0.3, but have expected returns equaling equities (or your targeted return), however, the portfolio Sharpe ratio is approximately 0.65 with an

expected return that equals equities (or your targeted return) and is not driven by any single asset class. The higher expected return per unit of risk is a product of this better diversification. The Sharpe ratio improvement implies an increase of approximately 65% in the portfolio's expected excess return if risk levels are held steady. Because this more diversified approach has a better Sharpe ratio than any asset or conventional mix of assets, it can be calibrated to deliver either higher returns with the same (or even less) risk, or the same returns with lower risk.

For a portfolio exhibiting a 10% annual volatility, we estimate this higher Sharpe ratio implies about 2.5% per year higher return than a conventional portfolio. In other words, by following the PMPT approach to asset allocation rather than the traditional MPT approach, the institutional investor can achieve about 2.5% per year more return at a similar level of risk. So, he could achieve a 10% targeted return, while holding a diversified portfolio of assets, without materially increasing his risks. Space limitations prevent me from outlining a host of additional benefits, such as a substantial reduction in fat tail risk, in this article. And of course as with any investment, there's a host of potential risks as no market or strategy is entirely predictable. Furthermore, as we all know, there are inherent risks of irresponsible or uneducated use of leverage.

Is there a downside? Leveraging asset classes and holding a balanced portfolio creates a different type of risk than holding a traditional portfolio with lower expected returns and a higher concentration in equities. Whereas the risk of the traditional portfolio is largely a function of the risk of equities, the risk of this portfolio is that other asset classes will, on average, underperform cash. We are comfortable with this risk for reasons previously explained; and, while we can't predict with certainty how things will play out in the future, we have stress-tested these concepts back to 1925 across multiple countries. Further, the amount of leverage required to create this type of portfolio is typically very low. If investors can get used to looking at leverage in a less prejudicial, black-and-white way—"no leverage is good and any leverage is bad"—I believe that they will understand that a moderately leveraged, highly diversified portfolio is considerably less risky than an unleveraged, non-diversified one.

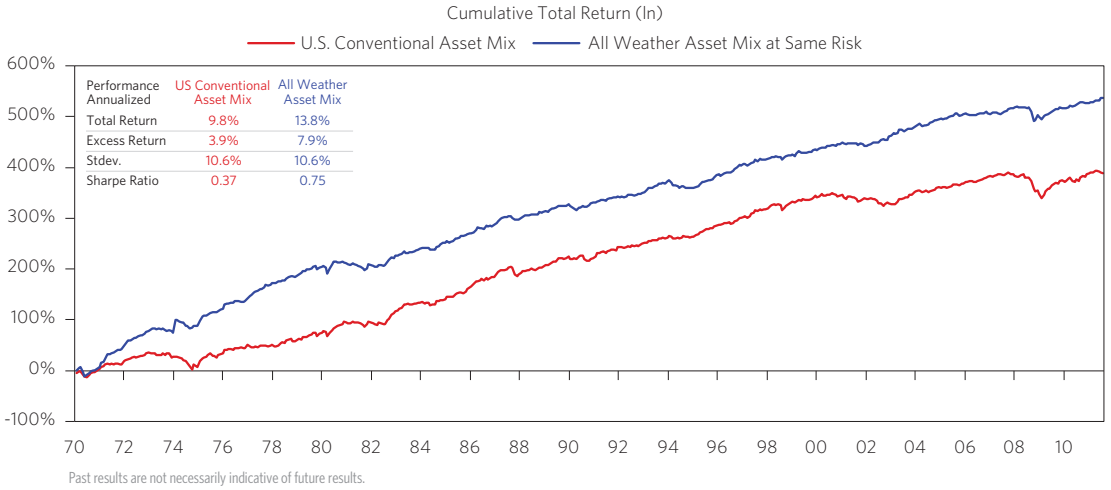
The "All Weather" Asset Allocation Mix

Following this approach, I created my own best strategic asset allocation mix in 1996. I did this to invest my family's trust assets for generations to come. Because picking alphas requires talent in those who select managers, and I could not be assured of this after my death, I wanted the portfolio to be 100% based on beta and geared to produce an equity-like return. I call the strategy "All Weather" because it is designed to perform well across different economic environments.

We can illustrate how these concepts would have performed by applying the asset allocation mix weights to market returns. This gives an indication of how the concepts stack up but is not indicative of how it would look if implemented for an institutional investor. This perspective is useful, as you can see the performance of the asset mix across a wide variety of environments, including high inflation, disinflation, asset bubbles and collapses.

Chart 3 shows the returns of the All Weather asset mix since 1970 run at the same level of risk as the conventional portfolio asset mix (roughly 60/40 stocks/bonds). As shown, the All Weather asset mix (the blue line) would have produced an additional 300–400 basis points of return per year at the same level of risk as the conventional portfolio (the red line).

Chart 3: All Weather Asset Mix Run at the Same Risk as the Conventional Portfolio



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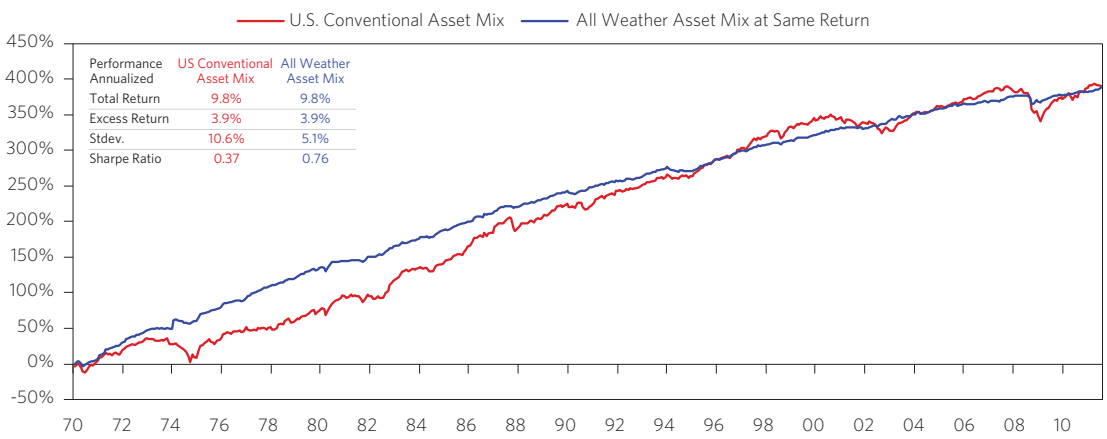
As previously mentioned, the All Weather portfolio's risk and return levels can be geared up or down to suit one's risk preference. Chart 4 shows the returns of the All Weather asset mix run at the same return level as the conventional portfolio. As shown, it would have produced the same return as the conventional portfolio with half the risk.

Chart 4: All Weather Asset Mix Run at the Same Return as the Conventional Portfolio



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Now let's say that you do not like these concepts and that you want to follow the traditional asset allocation process, conventionally looking at the risks and returns of assets (as shown in Chart 1). In order to get a 10% return, you will either have to concentrate all of your assets in a limited number of asset classes that have expected returns that average 10%, or you will have to get more alpha. That begs the question, how can you get more alpha?

HYPOTHETICAL PERFORMANCE RESULTS HAVE MANY INHERENT LIMITATIONS, SOME OF WHICH ARE DESCRIBED BELOW. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THOSE SHOWN. IN FACT, THERE ARE FREQUENTLY SHARP DIFFERENCES BETWEEN HYPOTHETICAL PERFORMANCE RESULTS AND THE ACTUAL RESULTS SUBSEQUENTLY ACHIEVED BY ANY PARTICULAR TRADING PROGRAM. ONE OF THE LIMITATIONS OF HYPOTHETICAL PERFORMANCE RESULTS IS THAT THEY ARE GENERALLY PREPARED WITH THE BENEFIT OF HINDSIGHT. IN ADDITION, HYPOTHETICAL TRADING DOES NOT INVOLVE FINANCIAL RISK, AND NO HYPOTHETICAL TRADING RECORD CAN COMPLETELY ACCOUNT FOR THE IMPACT OF FINANCIAL RISK IN ACTUAL TRADING. FOR EXAMPLE, THE ABILITY TO WITHSTAND LOSSES OR TO ADHERE TO A PARTICULAR TRADING PROGRAM IN SPITE OF TRADING LOSSES ARE MATERIAL POINTS WHICH CAN ALSO ADVERSELY AFFECT ACTUAL TRADING RESULTS. THERE ARE NUMEROUS OTHER FACTORS RELATED TO THE MARKETS IN GENERAL OR TO THE IMPLEMENTATION OF ANY SPECIFIC TRADING PROGRAM WHICH CANNOT BE FULLY ACCOUNTED FOR IN THE PREPARATION OF HYPOTHETICAL PERFORMANCE RESULTS AND ALL OF WHICH CAN ADVERSELY AFFECT ACTUAL TRADING RESULTS.

The Optimal Alpha Portfolio

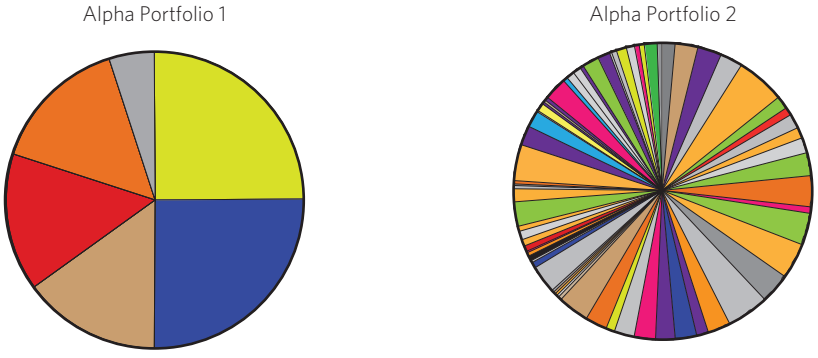
The basic principles in creating an Optimal Alpha Portfolio are the same as those behind the Optimal Beta Portfolio—create a well-diversified portfolio of uncorrelated return streams calibrated to balance each other and to deliver a targeted return. The only difference here is that we apply these principles to alphas instead of betas.

There are two ways an Optimal Alpha Portfolio can be created. The first, and currently the most popular, is via alpha overlay; the second is to create a portfolio of different alphas, regardless of the asset classes in which they are generated. In both cases, alpha is independent from beta and is overlaid on the beta. For example, when Bridgewater provides alpha overlay, each client chooses its beta and benchmark, which we replicate and then overlay with our own Optimal Alpha Portfolio. The client specifies a targeted tracking error (risk) for the alpha. Following the second approach, each manager's alpha is viewed as a separate return stream and combined into one alpha portfolio. Although we consider the second approach to be the best, both lead to significant improvements from conventional techniques. In both cases, most of the basic concepts are the same.

The traditional approach to investing typically leads to an undiversified portfolio of relatively poor alphas because the alphas are tied to the betas, rather than being chosen on the basis of what source is best. For example, because most traditional investors have a large amount of money invested in domestic equities, they have a large amount of alpha coming from domestic equities. Not only is the alpha portfolio poorly diversified, because too much of the alpha is coming from domestic equities, but because the domestic equity market is one of the toughest markets to generate alpha in, the alpha is smaller than it would be if it were chosen on its own merit, without a link to a particular asset class.

Choosing the best alphas and creating a diversified portfolio of them—whether that is achieved by allowing each manager to diversify his alphas or by using many managers' alphas to create a well-diversified total portfolio of alphas—will yield radically better results than the traditional portfolio. For proof, compare the results of Alpha Portfolio 1 and Alpha Portfolio 2 in Chart 5. Each pie represents 100% of the opportunity set and each slice of the pie represents one alpha source as a percentage of all of the alpha sources. In our example, the average information ratio of each slice of both pies is 0.35. So, the alphas in Alpha Portfolio 1 and Alpha Portfolio 2 are equally good. However, because Portfolio 2 contains more, better balanced, and less correlated sources of alpha, its information ratio is approximately 2.5 times better than Portfolio 1.

Chart 5: Structuring an Optimal Alpha Portfolio



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In other words, the increased diversification from additional sources of lower-correlated alphas (that are balanced better) can lead to a much higher return per unit of risk. Since alphas can be calibrated, you can choose whether to use this improved ratio to derive a higher expected return with comparable risk, or a lower risk with a comparable return. The alpha overlay manager's ability to create a well diversified portfolio of alphas is improved because alphas can come from diverse places and can be balanced well, providing a dramatic advantage over the traditional manager who cannot diversify and balance alphas as well. We have found that, by following this general approach, information ratios can increase by factors of two to four times.

The concept here—**the total return of a portfolio equals the return of the asset classes invested in, plus the managers' alpha**—is equally true if the alpha is produced in the same markets as the asset class or in different markets. A portfolio constructed by independently choosing the asset class (beta) and the alpha is not necessarily riskier than one managed by following the traditional approach, where the alphas come from the same markets as the betas. However, by choosing alphas from wherever they are best obtained and creating a much more diversified portfolio of alphas, you can produce much better risk-adjusted alphas through a properly executed alpha overlay strategy.

In summary, we believe that an enhanced ability to better balance the returns coming from alpha and beta; creating more diversified beta portfolios calibrated to one's targeted returns; and creating better and more diversified alpha portfolios, also calibrated to one's targeted returns, investors can dramatically improve their portfolio's overall results.

The Future of Investment Management

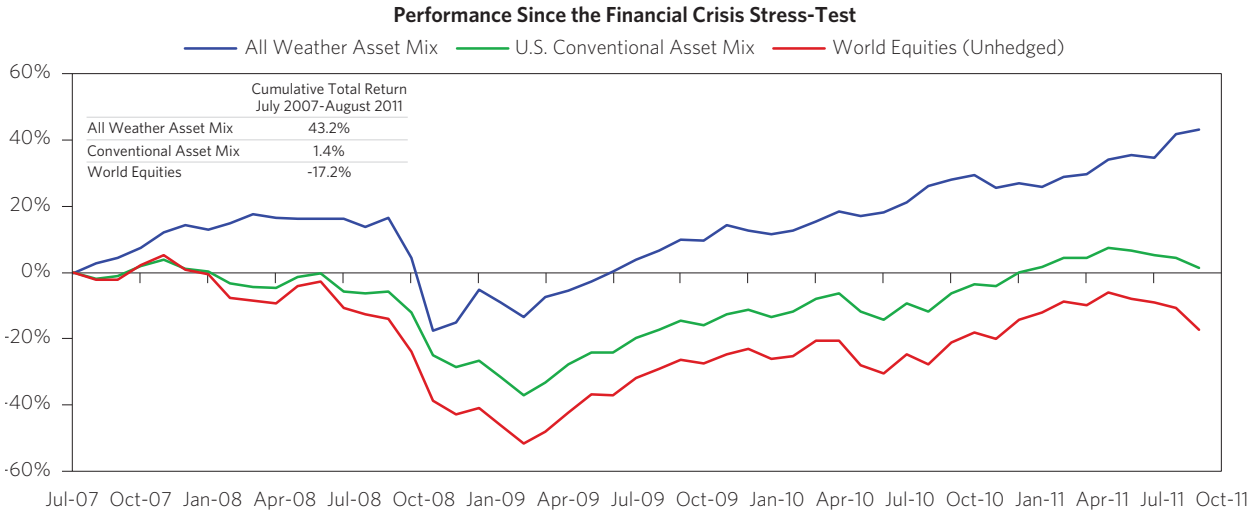
Since I firmly believe in the inevitability of evolution, and I believe this PMPT approach to structuring institutional portfolios is substantially better than the more traditional MPT approach, I am confident that the investment management industry will evolve toward having two broad types of investment managers—those who efficiently create betas and those who are alpha generators. Many of the alpha generators will replicate the betas and throw them in without additional charge (as we do now). Alpha generators will produce their alphas in the best ways they can, unconstrained by not having to link them to betas, though they will be more constrained by sensible controls (that is, controls that limit their concentration risks or their VaRs). These alpha managers will also adjust the sizes of their alphas to suit the client's tastes—for example, one client might choose a 3% tracking error while another might choose 6%. All alpha managers will compete with each other, without regard to the betas. Rather than "equity managers" competing with other "equity managers" in the investor's equity piece of the pie, all alpha generators will compete with each other for the whole enchilada.

Hedge funds are making progress along these lines, in part because they have the most freedom to engineer their alphas. These funds are helping to foster change throughout the investment industry, causing investors to ask themselves if they should let their traditional managers operate by the same rules as hedge funds. But hedge funds will be forced to change as well. In this new paradigm, investors will realize that there is no such thing as a hedge fund asset class. When one makes an allocation to hedge funds, one is really investing into a *bouillabaisse* of different betas and alphas, but mostly alphas. These alphas can be overlaid on top of just about any asset class. For example, an investor can compare the alternative of having his domestic equities (benchmarked against the S&P 500, say) managed by a domestic equity manager who has a tracking error of 4%, or buying S&P 500 futures and investing 50% of his money in a hedge fund-of-funds that has a tracking error of 8%. So traditional managers, hedge fund managers, and alpha overlay managers will all compete to produce the best alphas.

I am convinced these changes will happen extremely fast and trigger profound changes in both investing and the investment management business.

Reflections on the Acid Test

When I first came up with the All Weather approach to asset allocation, which applies modest amounts of leverage in order to achieve better diversification, the most commonly expressed concerns were: 1) that leverage would produce more risk than diversification would take away, and 2) that unstable correlations would create unanticipated risk. Although we back-tested this strategy to 1925, it was not until the recent financial crisis that we had a crisis like the Great Depression to stress-test these concepts in real time—i.e., at a time when leveraged strategies and correlation dependencies are severely tested. During this period, the All Weather asset mix performed as expected. In comparison to almost all other asset allocation mixes and other investment strategies, the All Weather asset mix had less risk and better returns. We can illustrate how the All Weather asset mix would have performed by applying the asset allocation mix weights to market returns since the crisis began. This gives an indication of how the concepts stack up but is not indicative of how it would look if implemented for an institutional investor. Since the onset of the crisis, the All Weather asset mix (blue line) gained 43% while the Conventional asset mix (green line) has been roughly flat, up around 1%.



Note that the Bridgewater returns deviated from the All Weather asset allocation mix returns during the crisis as a result of shifting to an asset mix designed to cut risk and preserve capital.

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PAST PERFORMANCE IS NOT INDICATIVE OF FUTURE RESULTS.

Why the All Weather Risk Balancing Approach Withstood the Stress-Test of 2008

The All Weather approach to asset allocation leverages up low risk assets and deleverages high risk assets so that the expected returns and risks of all the assets in the portfolio are roughly the same. This approach to asset allocation produced a better return to risk ratio than the Conventional portfolio mix for a simple reason: risk decreased more from better diversification than increased from the use of leverage.

Leverage was not a problem for a few reasons. First, leverage is used to create volatility in lower risk assets which creates better diversification than would be possible without leverage. For example, if I put 50% of my money in an unleveraged Treasury bond and 50% of my money in stocks, my portfolio would have been dominated by stocks because stocks are more volatile; however, if I leveraged my bonds to have the same volatility as stocks, I would have had much better diversification and would have had much lower risks during the financial crisis. Second, All Weather doesn't use very much leverage; the strategy is around 2 times leveraged, which is less than the amount of leverage an average large company in the S&P 500 employs and about 1/10th the leverage the average U.S. bank employs (which we think is too much). Third, leverage is employed in a range of highly liquid forms that can be rebalanced and liquidated if asset prices fall. Finally, in those areas where counterparties are the source of leverage, we actively limit exposure to lenders and actively select which lenders are most reliable funding sources. As a result, the leverage itself was not a problem in affecting the performance of the All Weather strategy throughout the crisis period.

Incorrect correlation assumptions were also not a problem because we don't use them in the weighting process because they aren't stable. Instead, our weighting of assets is based on understanding the ways that discounted economic conditions are reflected in asset pricing, and by ensuring the asset mix holds exposures that are equally balanced across environments, and most importantly balanced with respect to rising and falling growth and inflation rates. This framework held up in the crisis period. In the crisis, those assets that do badly when growth falls relative to expectations (e.g., equities) did poorly, but were significantly offset by those assets that do well when growth is weaker than expected (e.g., Treasury bonds). By leveraging the bonds up so that our bond exposure was comparable to our equity exposure, these positions could balance each other; whereas if leverage couldn't be used, they could not. In comparison, the Conventional portfolio performance is more concentrated toward equities so it does worse when growth disappoints and did worse in the crisis.

While I am not surprised, I am very pleased to see that this approach to strategic asset allocation, which has been proven out since we developed it 15 years ago and in over 85 years of back-testing, is now gaining in popularity. I believe that, as this approach is increasingly adopted, it will have a radical beneficial impact on asset allocation that will be of a similar magnitude to that of traditional portfolio theory as it gained acceptance.

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The All Weather asset mix performance is simulated by applying All Weather asset mix weights, which are determined by Bridgewater's proprietary process for building an environmentally balanced portfolio, to historical market returns. We use actual market returns when available and otherwise use Bridgewater Associates' proprietary estimates, based on other available data and our fundamental understanding of asset classes. Simulated asset returns are subject to considerable uncertainty and potential error, as there is a great deal that cannot be known about how assets would have performed in the absence of actual market returns. The All Weather asset mix simulation is an approximation of our actual process but not an exact replication, and may have differences including but not limited to the precise mix of markets used and the weights applied to those markets. It is expected that the simulated performance will periodically change as a function of both refinements to our simulation methodology and the underlying market data. Where noted, the All Weather Asset Mix Net of Fees returns have been calculated using our standard fee schedule for a minimum size account, which are the highest fees we have or would currently charge an account. Investment advisory fees are described in Bridgewater's ADV Part 2A. No claim is being made of the All Weather Asset Mix's ability to perform in absolute terms or relative to any market return in the future, during market events not represented or during market events occurring in the future. Market conditions and events vary considerably, are unpredictable and can have unforeseen impacts resulting in materially adverse performance results.