

An Open Letter to Investors
by Ray Dalio

BRIDGEWATER

Post Modern Portfolio Theory

Engineering Targeted Returns and Risks

The bear market in stocks, and interest rate declines to low levels, have raised many investors' concerns over having too much invested in equities and having too low expected returns. Defined benefit pension plans are the most sensitive to low interest rates implying low return expectations. That is because pension plan accounting regulations require them to project returns for their assets, match them up against their projected liabilities and then both account for and fund the gap. The accounting can cause big hits to their earnings and the funding can create substantial cash flow demands. Similarly, endowments and foundations are finding that these low and volatile returns are threatening their spending plans. This situation is leading institutional investors to rethink how to structure their portfolios.

The drive to solve these two problems (i.e., too much concentration in equities and too low projected returns) is leading to some very fundamental changes in how money is being managed. One effect has been for investors to seek high returning and uncorrelated sources of returns. The increased consideration of hedge funds, portable alpha and alpha overlay strategies are examples of this. Even more profoundly, much more attention is being paid to how to engineer portfolios to produce specified targeted returns and risks. As a result, this is leading to portfolio engineering advances.

By applying the process explained in this article, portfolios can be constructed to achieve your targeted returns and risks. For lack of a better term, I will call this engineering process "Post-Modern Portfolio Theory" (PMPT) because it builds on the concepts of portfolio theory, but goes a couple of steps beyond. Before explaining this process, I want to emphasize that is not just a theory. I am going to explain a process that I have used for a substantial portion of my personal investments for several years and is now being used by large institutional investors.

Some Basic Principles

Let's suppose that you want to engineer a portfolio that will have a targeted return of 10% and you want to do this with the lowest possible risk. What will you do?

Since the returns of your portfolio will equal the weighted average of the return streams that make it up, you will have to decide on a mix of return streams that will average 10%. Returns come from two sources - betas (i.e., the asset classes' returns) and alphas (i.e., the returns from deviating from the asset classes' mixes). Each beta and each alpha provides a return stream. When deciding on your asset allocation mix and your investment managers, you are deciding on how much to allocate to each of these return streams. The traditional approach to deciding on that mix follows one path to come up with the "ideal" mix of return streams, while the "Post-Modern Portfolio Theory" (PMPT)

approach follows a slightly different path to determining the mix. In essence, the traditional path is to a) combine asset classes based on their expected returns, risks and correlations with other asset classes, and once the asset allocation mix is determined, to b) pick the best possible managers of these asset classes. In the PMPT approach, a) the expected returns and risks of the asset classes are altered to allow better asset diversification without sacrificing returns, and b) the return streams coming from manager alphas are combined to optimally balance each other.

The first step in the engineering process is to decide on how much of the excess returns (i.e., over cash) should come from the betas (i.e., the asset class returns) and how much to get from the alphas (i.e., manager's value-added). While betas and alphas both provide returns streams, they are very different in character.

Betas (i.e., asset classes' returns) are limited in number (i.e., there are not many viable asset classes), they are normally relatively correlated with each other and their excess returns (i.e., returns above cash) are relatively low relative to their excess risks (i.e., their Sharpe ratios are typically between 0.2 to 0.3). But they are reliable - i.e., we can be confident that it will be profitable to hold them instead of cash, over long time horizons.

Alphas (managers' value-added), on the other hand, are plentiful, they are relatively uncorrelated with each other and their returns are unreliable - i.e., their risk-adjusted returns are slightly negative on average and the range around this slightly negative average is very large over long time horizons. The risk-adjusted returns of alpha are slightly negative because a) value-added is zero-sum - i.e., in order for one manager to add value, another one must lose - and b) there are transactions costs and fees. The range of risk-adjusted returns around this slight negative average is enormous because, in this zero-sum game, the smart managers take money away from the dumb ones. These characteristics of alpha make the rewards and penalties of a) choosing managers and b) balancing their alphas well or poorly, very large. Unlike the returns that come from beta (i.e., holding asset classes), which you can be confident will be positive over time regardless of which you chose; the returns from alpha might not exist if you do not choose wisely. But, if you select well, you can create a much better portfolio of alphas than you can of betas because you have many more, less correlated and more attractive return streams to combine in an efficient portfolio.

So:

- a. While the ability to create an efficient portfolio of betas is limited by the limited number of them and their relatively high correlation, the confidence that you will eventually have a positive result, even if you choose poorly, is high; and

- b. While the ability to create an efficient portfolio of alphas is great because of the large number of them and their relatively low correlations, the penalties for choosing poorly are large.

In order to get a targeted return (e.g., 10%) that is higher than that which can be locked in via market pricing (e.g., 4%), one has to take some risk. The question is, which risks are you most comfortable taking? So, the first decision you have to make in determining how to engineer the optimal portfolio to meet your objective (e.g., a 10%/year expected return) is how much risk do you want to take via the beta and how much risk do you want to take via the alpha. If you are very comfortable with taking beta risk and uncomfortable taking alpha risk, you might decide to engineer your portfolio to only have beta risk, in which case you will have to engineer the "beta portfolio" to have 100% of your targeted return (e.g., 10%). Or, you could choose the opposite - i.e., to have no beta risk and to try to engineer your "alpha portfolio" to produce 10%/year. Most investors have a mix (e.g., 80% from beta and 20% from alpha) that they backed into and never calculated. In the PMPT approach, this mix of beta and alpha is explicitly chosen. Which mix you choose should largely depend on how good you are in selecting managers, which you can probably tell by looking at the alphas your managers have generated in the past on average.

As portfolios are currently configured (using traditional approaches), I'd say that about 80% of the total return comes from beta and 20% comes from alpha. I don't know whether or not that will change with these newer, more engineered approaches being employed and I have no opinion concerning whether or not it should change. However, I am confident that those who know how to select and balance managers will be in much greater demand in the future because the potential for being able to develop fantastic results from creating portfolios of alphas will be better recognized than it has been. Also, for reasons explained later, I believe that good managers' alphas will improve because the investors who hire them will allow them to balance their bets better.

In the portfolio engineering that we have done to-date, we stuck to something like an 80% beta/20% alpha mix. For example, for the client who we engineered a 10% targeted return for, 80% of the excess return (i.e., over cash) came from beta and 20% came from alpha.

Beta Portfolios (i.e., Asset Allocation)

Asset classes have quite different expected returns and risks, but similar risk-adjusted returns. I believe that the main reason they have similar risk-adjusted returns is because they can be made "competitive" with each other and "arbitraged" through leverage. In any case, because the expected returns and risks asset classes look something like that which is shown in the below

charts, investors seeking returns that are higher than are available from the low risk assets tend to buy as much of the high returning asset classes (particularly equities) as they can stand, and then sprinkle in some of the others (mostly bonds) for diversification. They select the asset mix that way just because that's how the expected returns of these asset classes come prepackaged.

However, since the risk-adjusted returns of these asset classes are similar, the expected returns and risks of these asset classes can be made similar through leverage (or leveraging-like techniques). By borrowing cash to leverage up lower returning asset classes (and deleveraging asset classes that are higher returning than equities) so that they have the same expected volatilities as equities, the expected returns of these asset classes can be made similar to equities. Chart 2 shows the returns of these asset classes after leveraging and deleveraging them to have the same volatility as equities. As shown, their returns are similar and all of their Sharpe ratios fall in the 0.2 to 0.3 vicinity. The only difference between the returns shown in the first chart and those shown in the second chart is due to packaging. For example, it is a very simple task to create structured products that convert asset classes as shown in Chart 1 into asset classes as shown in Chart 2. So, the selection that investors can choose from can easily be the second selection rather than the first. If investments happened to come packaged in the second form rather than the first, the asset allocation mix one

would choose would look very different. There would no longer be the compelling need to concentrate so much money into equities to get the high returns, because the expected returns of all of the choices would be similar (in fact, they can be leveraged to be identical).

The main difference between these asset classes will then be their correlations. Since all of the assets now have expected returns that are similar to equities, a diversified portfolio of them will have an expected return that is about the same as equities, but with much less risk than either equities or the "typical portfolio" that is a mix of equities and other investments. That is because all of the investments have the same expected return as equities, but 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 has a high concentration in equities). In a traditional portfolio, combining asset classes that have Sharpe ratios of 0.2 to 0.3 typically yields a portfolio Sharpe ratio of about 0.4, with an expected return that is lower than equities. However, by combining the repackaged assets that still have information ratios of 0.2 to 0.3, but have expected returns equaling equities, the portfolio Sharpe ratio is about 0.65 with an expected return equaling equities¹. For a portfolio with 10% annual volatility, this higher Sharpe ratio would imply a 2.5% per year higher return than a conventional portfolio.

Just as one can leverage up or deleverage asset classes to have expected risks and returns that are similar to equities, one can leverage them up or down to just about any expected return and risk level. So, investors seeking an 8% expected return from their "beta" portfolio can leverage them all up to have estimated expected returns of 8% and then hold a diversified portfolio of them to generate an expected 8% return with much less risk. As mentioned, we have created portfolios that have expected returns of 8% to 10% and have less risk than traditional portfolios that now have expected returns of only 5% to 6%. The beta portfolio we created for our client seeking a 10% expected total return, 8% coming from beta, has an expected standard deviation of about 10%.

Leveraging-up other asset classes to have the same expected returns as equities, and then holding a balanced portfolio of them, creates a different type of risk than holding a traditional portfolio (which has lower expected returns and more 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, under-perform equities. We are very comfortable with this risk as capitalism, based on the concept of capital formation, requires other asset classes, on average, to have higher returns than equities.

Chart 1

Expected Rates of Return for Various Asset Classes

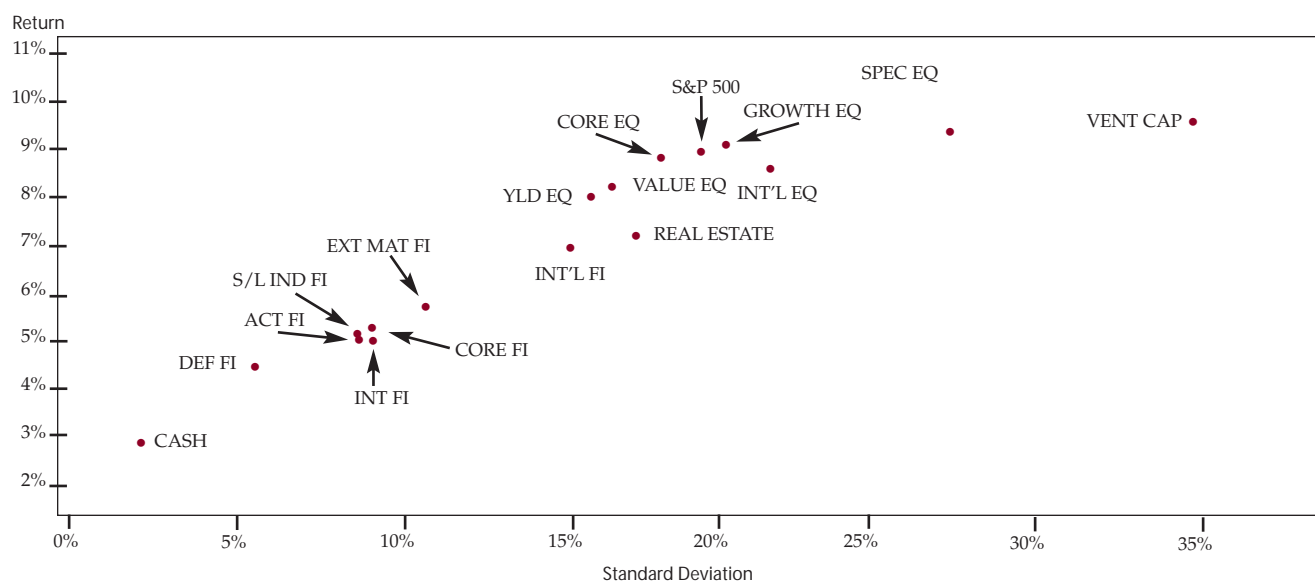
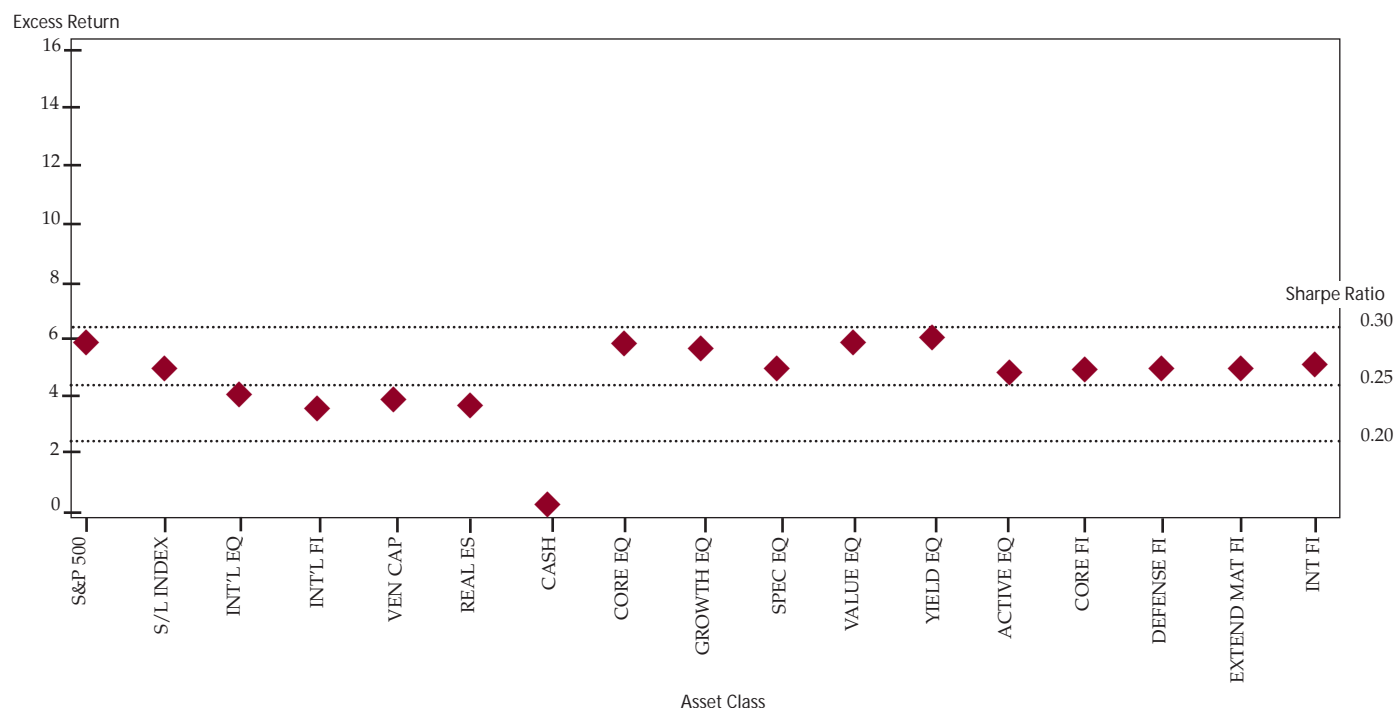


Chart 2

Leverage Adjusted Expected Excess Returns
(Standardized to S&P 500 Risk Level)



My All Weather Portfolio

As mentioned, I created my own portfolio, following this approach, six years ago. I did this to put my family trust money in. So it consists of that mix of that return streams that I must decide on and stick with essentially forever. Because alphas require the talent of those who are doing manager selection, and I couldn't be assured of having this after my death, I wanted it to be based on 100% beta and geared to produce an equity-like return. I call it an "All Weather Portfolio" because it is designed to perform equally well in all environments. Table 1 shows the real-time returns² of that portfolio since I started investing in it.

Also in Table 2 are the simulated historical results of the All Weather Portfolio³ (based on the asset mix that our pension plan client who is looking for a 10%/year return chose) in relation to those of the S&P 500 and a 60/40 S&P 500/Lehman Government-Corporate mix. Note the differences in the maximum losses, especially over two years. In other words, the All Weather Portfolio would have generated better returns than equities with less than 60% of the risk of equities, and drawdowns far smaller than those of the standard 60%/40% asset mix over one and two-year time frames. Because it has a substantially better Sharpe ratio (i.e., excess return: risk) than any of the alternatives, it could have been calibrated to deliver a) higher returns with the same, or less risk, or b) the same returns but with lower risk, than any of the alternatives. Chart 3 above shows the accumulated returns above cash (US 3-month t-bill rate) over the last three years for the same All Weather asset mix.

Alpha Portfolios

Hedge funds are now being intensely looked at by institutional investors because they have provided relatively large and uncorrelated returns. These returns have come from a) having very little beta (i.e., essentially cash) and b) magnifying the alphas through the use of leverage. Hedge funds are not an asset class (i.e., beta); they are mostly alpha (or a portfolio of alphas). Because alphas are zero-sum, the success of institutions investing in hedge funds will hinge on their abilities to properly select and balance winning managers. As a result, institutional investors' experiences with hedge

funds will be wide-ranging.

Institutional investors' moves toward hedge funds is a major step forward in the evolutionary process of devising the best way to manage portfolios, but it will soon be replaced by far more profound changes. By investing in hedge funds, institutional investors who do it well will discover their power to produce extraordinary risk-adjusted returns by creating portfolios of winning alphas. Soon they will be looking at the alphas that come from the active management of their traditional asset classes and thinking about how they can be reengineered and combined into a larger portfolio of alphas that will include hedge funds. So, what is now mistakenly considered an investment in the "hedge fund asset class" will evolve into a much larger portfolio of alphas that will combine all different types of alpha. These include portable alpha and alpha overlay strategies.

This is not pie-in-the sky. It is now happening. For example, we are now finding that nearly half of our new mandates allow us to overlay our Pure Alpha/hedge-fund strategy on top of the client's specified beta market. In other words, the client specifies the desired beta (i.e. asset class) and the targeted tracking error that we should run our Pure Alpha overlay strategy at. Because we can balance our sources of value-added better (i.e. not have as concentrated bets), this allows us to give them either more return for a specified amount of risk, or less risk for a specified amount of return, than is possible through traditionally structured mandates. We are just seeing the tip of the iceberg. Evolution is driving money to increasingly be managed this way.

For example, the movement of institutional investors to include hedge funds in their portfolios is leading these investors to realize that they are allowing their hedge fund managers to operate by far more liberal rules than they allow their non-hedge fund managers to operate by. This reconciliation process will lead to changes that will affect the entire portfolio, not just that small slice devoted to hedge funds. Their need to reconcile these differences will lead their traditional managers and their hedge fund managers to operate by similar rules.

Soon the information ratios of both types of managers will be compared and the "traditional managers" will have to compete with the "hedge fund managers" for the piece of the investor's pie that has been allocated to "alpha" and the distinction between "traditional managers" and "hedge fund managers" will fade away.

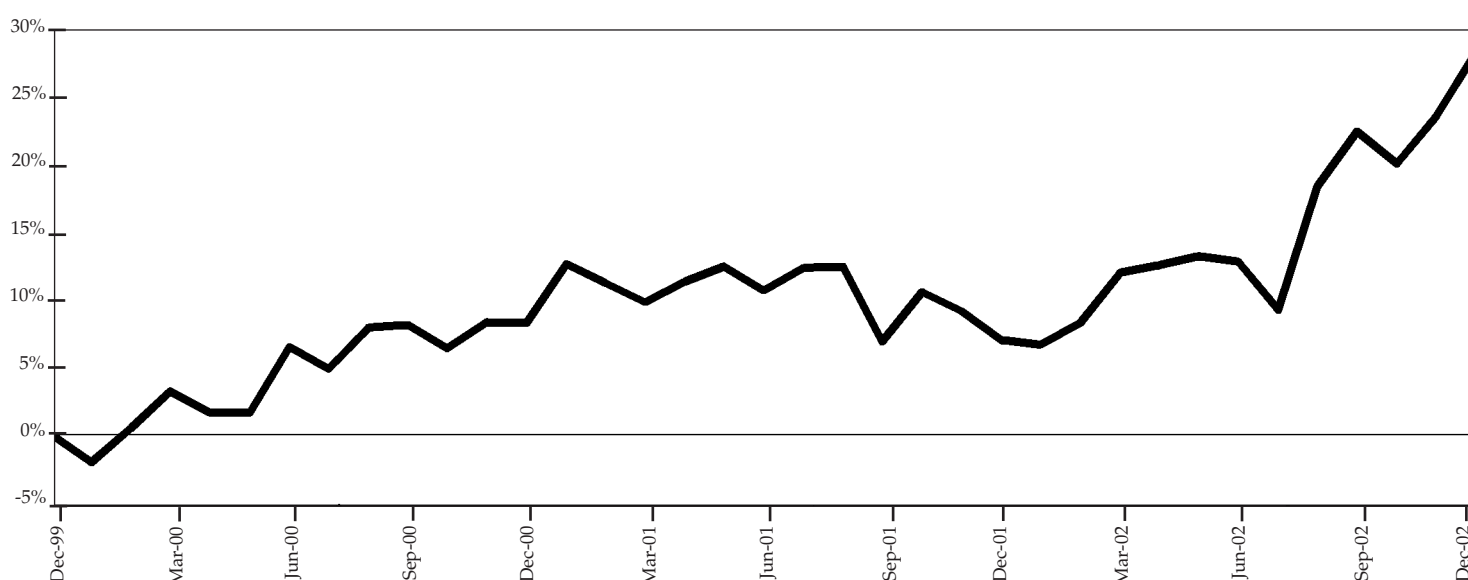
The differences in the alphas of "hedge fund managers" and "traditional managers" arises primarily from them operating under different constraints. Because of the greater freedom that hedge fund managers have, they can engineer superior results to traditional managers. For example, a) the main reason that a good hedge fund manager's returns are bigger than a good traditional manager's is that the hedge fund managers can use leverage to magnify them; b) the main reason that hedge fund managers' returns are uncorrelated with asset class returns is that they have little or no beta; and c) the main reason that good hedge fund managers can provide higher information ratios than traditional managers is that they can balance their bets more efficiently. These engineering advantages are the reasons that our hedge fund strategy (Pure Alpha) has outperformed our traditional investment products.

In other words, hedge funds are allowed to operate with much greater leeway than traditional managers, which is a huge competitive advantage, if they use this freedom wisely. The process of reconciling the differences between what hedge funds and what traditional managers are allowed to do will lead to institutional investors having a much better understanding of financial engineering and that will lead them to make more intelligent choices. For example, it is inevitable that investors will ask themselves questions like:

- a. *How can I balance this alpha (from a traditional manager) with that alpha (from a hedge fund manager), leading them to discover that the sizes of the alphas can be calibrated via the use of leverage, leading to conclusions like, "if I let the hedge fund manager leverage up to get a 5% tracking error, and I think that the ground rules for my traditional manager should be the same, I can use leverage to calibrate the alphas I get from my traditional managers to meet my goals."*

Chart 3

All Weather Asset Mix
(Accumulated returns above cash over the last three years)



See Footnote 2

¹ Balancing the assets in the portfolio once they are leveraged to the desired return or risk levels is a matter of correlation. One could either look at what correlations have been in the past, or form a view about what will drive correlations in the future. We looked at it both ways and came up with essentially the same asset allocation mixes. Because we believe that the pricing of asset classes reflects the consensus outlook for growth and inflation, and that the relative performance of asset classes is driven primarily by changes in this consensus outlook, we like to balance our portfolios so that they are insensitive to changing economic conditions.

² HYPOTHETICAL OR SIMULATED PERFORMANCE RESULTS HAVE CERTAIN INHERENT LIMITATIONS. UNLIKE AN ACTUAL PERFORMANCE RECORD, SIMULATED RESULTS DO NOT REPRESENT ACTUAL TRADING. ALSO, SINCE THE TRADES HAVE NOT ACTUALLY BEEN EXECUTED, THE RESULTS MAY HAVE UNDER - OR OVER-COMPENSATED FOR THE IMPACT, IF ANY, OF CERTAIN MARKET FACTORS, SUCH AS LACK OF LIQUIDITY. SIMULATED TRADING PROGRAMS IN GENERAL ARE ALSO SUBJECT TO THE FACT THAT THEY ARE DESIGNED WITH THE BENEFIT OF HINDSIGHT. The All Weather Net of Fees returns have been reduced by a standard 35 bp pa investment management fee. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. Trading in futures is risky and can result in losses as well as profits. PAST PERFORMANCE IS NOT NECESSARILY INDICATIVE OF FUTURE RESULTS.

³ The performance history provided above is based on the returns of the Bridgewater "All Weather" strategy implemented for Bridgewater's principals. The performance provided is gross of fees and includes the reinvestment of all interest, gains, and losses. Returns will be reduced by investment advisory fees and any other expenses that may be incurred in the management of any portfolio. No representation is being made that any account will or is likely to achieve returns similar to those shown. Trading in futures is risky and can result in losses as well as profits. PAST PERFORMANCE IS NOT NECESSARILY INDICATIVE OF FUTURE RESULTS.

Table 1

Quarter	Quarterly Return
2Q96	2.02%
3Q96	10.28%
4Q96	7.29%
1Q97	-5.34%
2Q97	9.95%
3Q97	11.44%
4Q97	-0.34%
1Q98	2.87%
2Q98	-0.55%
3Q98	-1.69%
4Q98	-1.90%
1Q99	4.49%
2Q99	1.62%
3Q99	4.27%
4Q99	4.91%
1Q00	3.20%
2Q00	3.76%
3Q00	-2.51%
4Q00	5.81%
1Q01	-4.76%
2Q01	-0.56%
3Q01	-1.27%
4Q01	1.13%
1Q02	3.27%
2Q02	1.82%
3Q02	2.02%
4Q02	3.18%
Annualized Returns	9.78%
Standard Deviation	10.85%

See Footnote 3 on prior page

Table 2

	S&P 500	Lehman Gov't/Credit	60% S&P 500 40% Lehman Gov't Credit	All Weather Gross of Fees	All Weather Net of Fees
Total Annual Return Since 1970	11.3%	8.6%	10.2%	13.0%	12.6%
Total Annual Return Since 1980	13.0%	9.8%	11.7%	12.2%	11.8%
Total Annual Return Since 1990	9.3%	8.1%	8.8%	11.3%	10.9%
Lowest 12 Month Return Since 1970	-38.6%	-8.6%	-26.5%	-13.8%	-14.1%
Lowest 24 Month Return Since 1970	-42.6%	-5.6%	-24.6%	-9.7%	-10.3%
Standard Deviation Since 1970	15.6%	6.0%	10.3%	9.0%	9.0%
Sharpe Ratio Since 1970	0.30	0.33	0.35	0.69	0.65

See Footnote 2 on prior page

- b. *Is it smart or dumb to insist that the source of the manager's alpha come from the same asset class that I have asked him to manage (e.g., insist that U.S. equities managers generate all of their alpha from U.S. equities bets), leading them to separate alphas and betas, which will allow preferable strategies - e.g., alpha overlays and portable alpha, etc.*

There are many other similar and important questions that the exposure to hedge funds will lead them to ask and the asking of these questions will lead to profound changes in the way institutional investors have their money managed.

This is not just theory; it is now happening at the smartest and most progressive funds. In other words, we are now seeing alphas being looked at independent of betas; they are being much more efficiently chosen based on their returns, risks and correlations. In some cases they are being engineered to deliver desired results (e.g., geared up or down) and quite often they are being combined into alpha portfolios, using the same concepts of modern portfolio theory that are now commonly used in determining asset allocation mixes.

Leverage

In order to effectively use the concepts of PMPT, one has to be willing to use leverage or leverage replicating processes. This is now typically much less of a hurdle than it was five or ten years ago. Over the past several years, leverage or leverage-like approaches, have entered most portfolios in different ways. Leverage is not now typically looked at in black and white terms - like believing that not having any amount of it is prudent and having some of it is dangerous. It is now generally recognized that leverage in investments, like leverage in business or leverage in one's personal finances, can and should be used prudently. We have often heard it said "if I don't mind buying stock in a

company or real estate that has debt, why should I mind having a limited amount of debt in my investment portfolio?"

Of course a leveraged portfolio is more risky than the same portfolio unleveraged. However, the more relevant comparison is between a) a diversified portfolio leveraged to have the same expected return as equities and b) an all-equity portfolio. Which is less "risky"? Injecting prudent amounts of leverage into your portfolio can allow you to obtain your desired levels of return with much less risk than via alternative approaches to attempting to generate these same returns.

It is also interesting to note that the return of a typical pension plan is about 95% correlated to equities. And equities, like all markets that we have studied, have "fat-tails", i.e. a high level of event risk. This means that the true risk of the typical portfolio is much higher than its standard deviation of returns. Leverage allows you to significantly increase portfolio diversification, substantially reducing event risk, while maintaining the same or higher expected return as today's typical portfolio. In other words, it is less risky to have more diversification with modest leverage than minimal diversification and no leverage.

There can also be non-investment related impediments to using leverage. For example, in the United States borrowing by pension funds produces adverse tax consequences. In these cases, de facto leverage can be created in other ways.

Conclusions

The concepts of PMPT are basically the same at those of MPT, with two major exceptions:

1. Asset classes are leveraged up and/or deleveraged to provide similar risks and returns that are targeted to the specified objective. For example, they

might all be leveraged to produce a 10% expected return, which will require lower return, lower risk assets to be leveraged more than those with higher expected returns and risk. These adjusted asset classes are then combined, primarily based on their correlations. In this way, a) a targeted return for the asset allocation mix can be achieved, even though the unleveraged expected returns might fall short of that target and b) better diversification (hence lower risk) is achieved.

2. Alphas are chosen and weighted primarily on the basis of their relationships with other alphas, rather than as extensions of investing in certain asset classes. For example, while the MPT approach (as it is commonly practiced) leads investors to have concentrated exposures to alphas that come from the management of assets that they have allocated the most money to (e.g., if they have allocated the most money to U.S. equities, they will have the most alpha exposure to their U.S. equity managers), the PMPT balances the alphas primarily on the basis of how they relate to each other and with little or no regard to what the asset allocation weights are. In some cases, (where possible like our Pure Alpha), the alphas can be geared-up or geared-down to enhance the balancing.

The net result of this process is that a) a better balance of return streams coming from both betas and alphas is achieved, which yields a higher excess return to excess risk ratio, and b) these excess returns and risks can be calibrated to meet the specified targets.

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