

Our Proprietary Approach to Strategic Asset Allocation

For decades, investment professionals have believed that the best way to maximize long-term returns and minimize risk is to diversify portfolios across a broad range of asset classes. Since various asset classes such as equities, bonds, commodities and real estate seemed superficially different, it was long thought that a portfolio divided among many asset classes was the best way to weather the ups and downs of different market conditions. However, the recent financial crisis proved disappointing to many investors in part because this approach to strategic asset allocation turned out to be far riskier than previously understood.

The Investment Strategy Group at Goldman Sachs has developed a new approach to strategic asset allocation that focuses not only on diversification across asset classes but also on diversification across the underlying sources of returns, which we call “return-generating factors.” In our model, each of the factors is associated with a long-term risk premium that is expected to reward investors who choose to take the risk. Much like the nutrients in our food – carbohydrates, proteins, fats – that make up the composition of our daily calorie intake, factor risk premia are the building blocks of long-term portfolio returns. While a chocolate candy bar might have the same amount of calories as a cereal bar, it may be saturated with carbohydrates and fat. Keeping the right balance is key to long-term success and well being, whether its nutrition or investing.

With this new factor-based approach, we are able to improve our estimates of potential long-term returns across asset classes and to better understand the extent of portfolio diversification each asset class provides – even in the most extreme of market conditions. Combined with our robust portfolio optimization technique, we are then able to construct well-diversified portfolios that we believe are more carefully tailored to our clients’ investment goals and preferences and whose long-term risk and return characteristics are expected to be superior to portfolios constructed using traditional approaches.

The approach moreover enables us to generate portfolio risk analytics and stress tests aimed to better capture severe downside risks, including extreme events such as the 2008-09 financial crisis. It also helps us better understand the behavior of portfolios in different economic conditions, such as when interest rates eventually begin to rise from the current low levels.

Brief History of Asset Allocation

Traditional approaches to asset allocation build on an idea known as the Modern Portfolio Theory, which originated in an article by Nobel prize-winning economist Harry Markowitz in 1952. The theory outlines how an investor can achieve the highest rate of return with the lowest possible risk by investing in assets whose prices tend to move independently of one another. For example, adding high-grade

bonds to a portfolio of equities should reduce the overall risk of the portfolio because when the stock market falls, bonds often rally.

A decade later, building on Markowitz' insights, another Nobel laureate economist William Sharpe helped derive a framework called Capital Asset Pricing Model (CAPM), which enabled investors to estimate the prospective returns of different investments based on their exposure to a single risk factor, the equity market. The CAPM soon became the default tool for understanding why some assets should reward investors with higher returns than others. In the early 1990s, Fischer Black and Bob Litterman of Goldman Sachs refined the ideas of Markowitz and Sharpe in their equilibrium model that allowed investors to combine their own return expectations with the CAPM's estimates. The resulting Black-Litterman model remains an industry standard among practitioners today.

While the majority of the asset management industry was using these traditional frameworks, a new set of techniques with promising future applications in investment management was cropping up elsewhere. In the emerging hedge fund industry, a breed of quantitative equity funds was increasingly using *multi-factor* models for stock selection. In the field of stochastic control, aerospace engineers among others were embracing a technique called *robust optimization* to calibrate efficient flight paths for instruments such as missiles. These techniques became the key building blocks of the new asset allocation approach developed by the Goldman Sachs Investment Strategy Group.

Challenges to Traditional Asset Allocation Approaches

During the financial crisis of 2008-09, traditional asset allocation theories faced a serious challenge as asset classes such as hedge fund strategies, commodities and real estate that were previously thought to

be largely uncorrelated suddenly started falling with the crashing equity market. Disappointed investors asked: If adding multiple asset classes to a portfolio does not provide adequate diversification, what does? Here, understanding the different risk factors that ultimately drive the prices of assets turns out to be very helpful.

The possibility that the stock market might lose money is just one type of risk. There are many other risk factors or components of risk. For example, the possibility that the Federal Open Market Committee might raise interest rates is another risk that can affect the prices of a number of different investments. Changes in exchange rates pose yet another risk for a global investor.

Traditional asset allocation approaches are based on one-factor models where the single factor is the market risk. Therefore, they ignore the other dimensions of risk, including the seemingly hidden risks that make asset prices move in near lockstep in times of crisis. The traditional one-dimensional approach is quite simply insufficient to address the complexity of the investment universe for today's global investors.

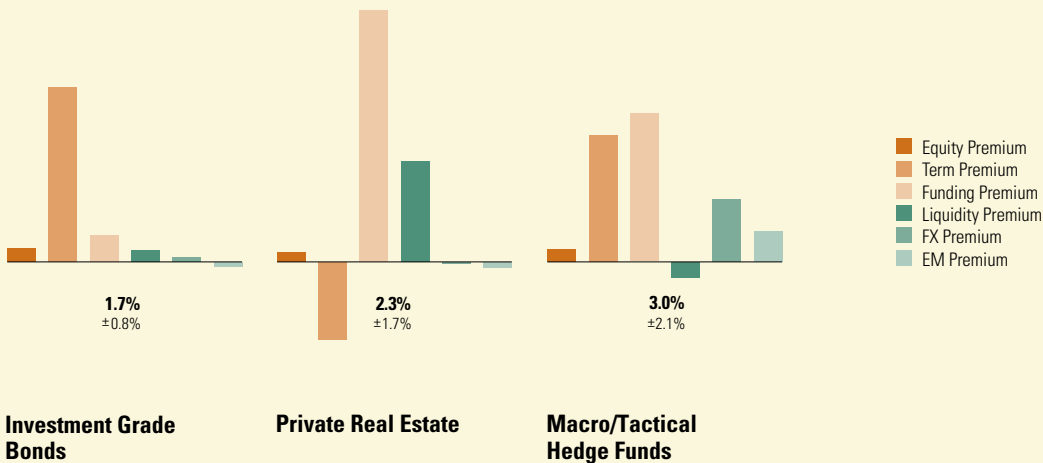
Our new multi-factor approach to asset allocation begins by acknowledging that the investment universe is complex. Just as the names of different foods tell us little about their nutritional contents, the names of asset classes typically tell us little about the risks involved, let alone identifying the risks that are worth taking. The use of multiple factors helps us better understand this complexity and the associated risks, including rare extreme events often referred to as *tail risks*.

Investing in a Multi-Factor World

Our new approach uses six different factors to describe the key drivers of asset price fluctuations in the global investment universe. They are: (i) market risk; (ii) inflation and interest rate risk; (iii) the risk in short-term funding conditions; (iv)

Exhibit 1: Examples of Risk Premium Profiles for Selected Asset Classes

Note: The total estimated risk premium and the associated standard error are displayed below each profile.



the risk of changes in market liquidity; (v) foreign exchange risk; and (vi) risks specific to emerging market countries.

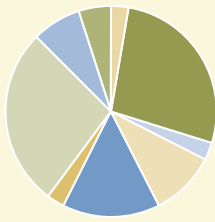
Importantly, every one of these six factors not only drives price fluctuations but is also a source of possible long-term returns for a global investor. That is, there is a clear economic rationale for why investors should be rewarded for taking each of the risks. As a result, the model helps us identify the risks that may be worth taking and steer clear of those risks that only add volatility to the portfolio. Moreover, each factor is largely independent of the others, which is key to constructing diversified portfolios.

As an example of how the multi-factor approach helps us better understand the sources of return even within complex asset classes, consider macro/tactical hedge funds. These funds try to profit from movements in global financial markets via long and short positions in assets such as bonds, currencies and

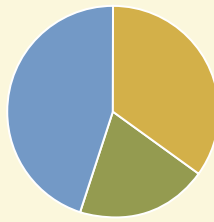
commodities, often using a substantial amount of leverage. Their strategies help ensure that they have limited exposures to stock market fluctuations. As a result, traditional models that rely on the equity factor alone predict that the average macro/tactical hedge fund should earn only a small reward – as little as 0.2% per year above riskless investments like Treasury bills. The past performance of these funds has of course been far superior. In contrast, using our six-factor model, we estimate that a typical macro/tactical fund should earn a long-term *risk premium* of about 3% above riskless investments – a number that more accurately reflects their return-generating potential. (Exhibit 1)

Moreover, as shown in Exhibit 1, the six-factor approach helps us understand where this return-generating potential is expected to come from: the returns on macro/tactical funds derive primarily from exposures to interest rate risk,

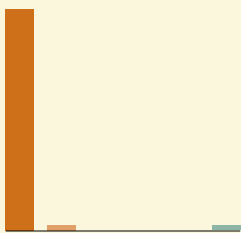
Exhibit 2: Diversification from a New Perspective



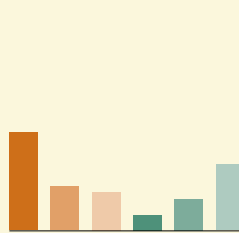
Asset Allocation



Asset Allocation



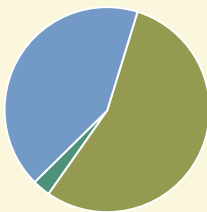
Undiversified Factor Allocation



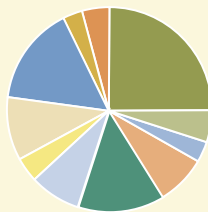
Diversified Factor Allocation

- Equity Premium
- Term Premium
- Funding Premium
- Liquidity Premium
- FX Premium
- EM Premium

Exhibit 3: Robust Optimization Acknowledges that Expected Returns are Uncertain



Traditional Optimization



Robust Optimization

- Inv. Grade Bonds
- High Yield Bonds
- EM Local Debt
- US Growth Equity
- US Value Equity
- Non-US Equity
- EM Equity
- Hedge Funds
- Private Equity
- Global Public REITs
- Private Real Estate

funding risk, foreign exchange risk, and emerging market risk, as revealed by their *risk premium profile*.

Exhibit 1 also displays risk premium profiles for two other asset classes: investment-grade bonds and private real estate. While the equity premium is very low in all three, the other five remaining factor premiums stand out. These examples help illustrate that each asset class has a unique risk premium profile, which creates a distinct investment identity that is almost completely ignored by traditional investment approaches that rely solely on the equity risk premium. Since each risk premium has the potential to generate returns, it can be seen that wealth accumulation may be possible even when the equity market is flat over the investment horizon.

This is an important insight that can be directly applied to portfolio construction, as illustrated in [Exhibit 2](#) for two hypothetical portfolios. The portfolio on the left appears to be more diversified from a traditional asset allocation perspective. But if you look closely at the portfolio on the right, it is substantially more diversified in terms of the return-generating power of all six risk premia. Allocating across a balanced risk premium profile is vital because not all factors generate returns all of the time. Over the last decade, for example, the risk premium of equities has fallen significantly short of its long-term average. But in that same period, a well-diversified portfolio would have continued to harvest returns from the other five risk premia in our model.

Importance of Uncertainties

While well-designed models can be useful in better understanding the drivers of risk and return across asset classes, it is important to acknowledge that no model perfectly describes the world. Importantly, significant uncertainties remain that must be accounted for in a thoughtful portfolio construction process. Our new

robust portfolio optimization framework seeks to explicitly account for such errors in our expected return estimates, which are the most important inputs to successful portfolio construction. For example, the risk premium we estimate for Emerging Market Local Debt is 5.7%, but it comes with an uncertainty of plus or minus 3.8%. That means the long-term average return above Treasury bills could potentially be as low as 1.9% or as high as 9.5%. It is clear that uncertainty can have a profound impact on average returns.

Crucially, traditional portfolio optimization processes based on the mean-variance approach of Markowitz completely ignore errors in expected return estimates, typically resulting in highly undiversified allocations, as illustrated in [Exhibit 3](#). Academic studies have demonstrated that such portfolios tend to deliver poor realized performance outcomes. That is, mean-variance optimization tends to *overpromise* and *underdeliver*. On the contrary, the realized average returns of portfolios constructed with our robust optimization process are closer to their expected returns.

Taken together, our six-factor model and robust optimization framework allows us to build portfolios that are better diversified across both asset classes and risk premia, helping us better address each investor's individual investment goals and preferences.

Art and Science of Asset Allocation

Although we believe we have pushed the scientific envelope of strategic asset allocation techniques, the holistic process of asset allocation remains a combination of both art and science. Investment expertise and qualitative judgment are particularly important in understanding individual investors' specific goals and softer preferences. But the entire process of strategic asset allocation has become more exact, which is a goal investment professionals have long sought to achieve. ■

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