EDUCATIONAL READING MATERIALS

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April 17, 2013

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The New York Times

March 30, 2013

State-Wrecked: The Corruption of Capitalism in America

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The Dow Jones and Standard & Poor's 500 indexes reached record highs on Thursday, having completely erased the losses since the stock market's last peak, in 2007. But instead of cheering, we should be very afraid.

Over the last 13 years, the stock market has twice crashed and touched off a recession: American households lost $5 trillion in the 2000 dot-com bust and more than $7 trillion in the 2007 housing crash. Sooner or later — within a few years, I predict — this latest Wall Street bubble, inflated by an egregious flood of phony money from the Federal Reserve rather than real economic gains, will explode, too.

Since the S.&P. 500 first reached its current level, in March 2000, the mad money printers at the Federal Reserve have expanded their balance sheet sixfold (to $3.2 trillion from $500 billion). Yet during that stretch, economic output has grown by an average of 1.7 percent a year (the slowest since the Civil War); real business investment has crawled forward at only 0.8 percent per year; and the payroll job count has crept up at a negligible 0.1 percent annually. Real median family income growth has dropped 8 percent, and the number of full-time middle class jobs, 6 percent. The real net worth of the "bottom" 90 percent has dropped by one-fourth. The number of food stamp and disability aid recipients has more than doubled, to 59 million, about one in five Americans.

So the Main Street economy is failing while Washington is piling a soaring debt burden on our descendants, unable to rein in either the warfare state or the welfare state or raise the taxes needed to pay the nation's bills. By default, the Fed has resorted to a radical, uncharted spree of money printing. But the flood of liquidity, instead of spurring banks to lend and corporations to spend, has stayed trapped in the canyons of Wall Street, where it is inflating yet another unsustainable bubble.

When it bursts, there will be no new round of bailouts like the ones the banks got in 2008. Instead, America will descend into an era of zero-sum austerity and virulent political conflict, extinguishing even today's feeble remnants of economic growth.

THIS dyspeptic prospect results from the fact that we are now state-wrecked. With only brief interruptions, we've had eight decades of increasingly frenetic fiscal and monetary policy activism intended to counter the cyclical bumps and grinds of the free market and its purported tendency to underproduce jobs and economic output. The toll has been heavy.

As the federal government and its central-bank sidekick, the Fed, have groped for one goal after another — smoothing out the business cycle, minimizing inflation and unemployment at the same time, rolling out a giant social insurance blanket, promoting homeownership, subsidizing medical care, propping up old industries (agriculture, automobiles) and fostering new ones ("clean" energy, biotechnology) and, above all, bailing out Wall Street — they have now succumbed to overload, overreach and outside capture by powerful interests. The modern Keynesian state is broke, paralyzed and mired in empty ritual incantations about stimulating "demand," even as it fosters a mutant crony capitalism that periodically lavishes the top 1 percent with speculative windfalls.

The culprits are bipartisan, though you'd never guess that from the blather that passes for political discourse these days. The state-wreck originated in 1933, when Franklin D. Roosevelt opted for fiat money (currency not fundamentally backed by gold), economic nationalism and capitalist cartels in agriculture and industry.

Under the exigencies of World War II (which did far more to end the Depression than the New Deal did), the state got hugely bloated, but remarkably, the bloat was put into brief remission during a midcentury golden era of sound money and fiscal rectitude with Dwight D. Eisenhower in the White House and William McChesney Martin Jr. at the Fed.

Then came Lyndon B. Johnson's "guns and butter" excesses, which were intensified over one perfidious weekend at Camp David, Md., in 1971, when Richard M. Nixon essentially defaulted on the nation's debt obligations by finally ending the convertibility of gold to the dollar. That one act — arguably a sin graver than Watergate — meant the end of national financial discipline and the start of a four-decade spree during which we have lived high on the hog, running a cumulative $8 trillion current-account deficit. In effect, America underwent an internal leveraged buyout, raising our ratio of total debt (public and private) to economic output to about 3.6 from its historic level of about 1.6. Hence the $30 trillion in excess debt (more than half the total debt, $56 trillion) that hangs over the American economy today.

This explosion of borrowing was the stepchild of the floating-money contraption deposited in the Nixon White House by Milton Friedman, the supposed hero of free-market economics who in fact sowed the seed for a never-ending expansion of the money supply. The Fed, which celebrates its centenary this year, fueled a roaring inflation in goods and commodities during the 1970s that was brought under control only by the iron resolve of Paul A. Volcker, its chairman from 1979 to 1987.

Under his successor, the lapsed hero Alan Greenspan, the Fed dropped Friedman's penurious rules for monetary expansion, keeping interest rates too low for too long and flooding Wall Street with freshly minted cash. What became known as the "Greenspan put" — the implicit assumption that the Fed would step in if asset prices dropped, as they did after the 1987 stock-market crash — was reinforced by the Fed's unforgivable 1998 bailout of the hedge fund Long-Term Capital Management.

That Mr. Greenspan's loose monetary policies didn't set off inflation was only because domestic prices for goods and labor were crushed by the huge flow of imports from the factories of Asia. By offshoring America's tradable-goods sector, the Fed kept the Consumer Price Index contained, but also permitted the excess liquidity to foster a roaring inflation in financial assets. Mr. Greenspan's pandering incited the greatest equity boom in history, with the stock market rising fivefold between the 1987 crash and the 2000 dot-com bust.

Soon Americans stopped saving and consumed everything they earned and all they could borrow. The Asians, burned by their own 1997 financial crisis, were happy to oblige us. They — China and Japan above all — accumulated huge dollar reserves, transforming their central banks into a string of monetary roach motels where sovereign debt goes in but never comes out. We've been living on borrowed time — and spending Asians' borrowed dimes.

This dynamic reinforced the Reaganite shibboleth that "deficits don't matter" and the fact that nearly $5 trillion of the nation's $12 trillion in "publicly held" debt is actually sequestered in the vaults of central banks. The destruction of fiscal rectitude under Ronald Reagan — one reason I resigned as his budget chief in 1985 — was the greatest of his many dramatic acts. It created a template for the Republicans' utter abandonment of the balanced-budget policies of Calvin Coolidge and allowed George W. Bush to dive into the deep end, bankrupting the nation through two misbegotten and unfinanced wars, a giant expansion of Medicare and a tax-cutting spree for the wealthy that turned K Street lobbyists into the de facto office of national tax policy. In effect, the G.O.P. embraced Keynesianism — for the wealthy.

The explosion of the housing market, abetted by phony credit ratings, securitization shenanigans and willful malpractice by mortgage lenders, originators and brokers, has been well documented. Less known is the balance-sheet explosion among the top 10 Wall Street banks during the eight years ending in 2008. Though their tiny sliver of equity capital hardly grew, their dependence on unstable "hot money" soared as the regulatory harness the Glass-Steagall Act had wisely imposed during the Depression was totally dismantled.

Within weeks of the Lehman Brothers bankruptcy in September 2008, Washington, with Wall Street's gun to its head, propped up the remnants of this financial mess in a panic-stricken melee of bailouts and money-printing that is the single most shameful chapter in American financial history.

There was never a remote threat of a Great Depression 2.0 or of a financial nuclear winter, contrary to the dire warnings of Ben S. Bernanke, the Fed chairman since 2006. The Great Fear — manifested by the stock market plunge when the House voted down the TARP bailout before caving and passing it — was purely another Wall Street concoction. Had President Bush and his Goldman Sachs adviser (a k a Treasury Secretary) Henry M. Paulson Jr. stood firm, the crisis would have burned out on its own and meted out to speculators the losses they so richly deserved. The Main Street banking system was never in serious jeopardy, ATMs were not going dark and the money market industry was not imploding.

Instead, the White House, Congress and the Fed, under Mr. Bush and then President Obama, made a series of desperate, reckless maneuvers that were not only unnecessary but ruinous. The auto bailouts, for example, simply shifted jobs around — particularly to the aging, electorally vital Rust Belt — rather than saving them. The "green energy" component of Mr. Obama's stimulus was mainly a nearly $1 billion giveaway to crony capitalists, like the venture capitalist John Doerr and the self-proclaimed outer-space visionary Elon Musk, to make new toys for the affluent.

Less than 5 percent of the $800 billion Obama stimulus went to the truly needy for food stamps, earned-income tax credits and other forms of poverty relief. The preponderant share ended up in money dumps to state and local governments, pork-barrel infrastructure projects, business tax loopholes and indiscriminate middle-class tax cuts. The Democratic Keynesians, as intellectually bankrupt as their Republican counterparts (though less hypocritical), had no solution beyond handing out borrowed money to consumers, hoping they would buy a lawn mower, a flat-screen TV or, at least, dinner at Red Lobster.

But even Mr. Obama's hopelessly glib policies could not match the audacity of the Fed, which dropped interest rates to zero and then digitally printed new money at the astounding

rate of $600 million per hour. Fast-money speculators have been "purchasing" giant piles of Treasury debt and mortgage-backed securities, almost entirely by using short-term overnight money borrowed at essentially zero cost, thanks to the Fed. Uncle Ben has lined their pockets.

If and when the Fed — which now promises to get unemployment below 6.5 percent as long as inflation doesn't exceed 2.5 percent — even hints at shrinking its balance sheet, it will elicit a tidal wave of sell orders, because even a modest drop in bond prices would destroy the arbitrageurs' profits. Notwithstanding Mr. Bernanke's assurances about eventually, gradually making a smooth exit, the Fed is domiciled in a monetary prison of its own making.

While the Fed fiddles, Congress burns. Self-titled fiscal hawks like Paul D. Ryan, the chairman of the House Budget Committee, are terrified of telling the truth: that the 10-year deficit is actually $15 trillion to $20 trillion, far larger than the Congressional Budget Office's estimate of $7 trillion. Its latest forecast, which imagines 16.4 million new jobs in the next decade, compared with only 2.5 million in the last 10 years, is only one of the more extreme examples of Washington's delusions.

Even a supposedly "bold" measure — linking the cost-of-living adjustment for Social Security payments to a different kind of inflation index — would save just $200 billion over a decade, amounting to hardly 1 percent of the problem. Mr. Ryan's latest budget shamelessly gives Social Security and Medicare a 10-year pass, notwithstanding that a fair portion of their nearly $19 trillion cost over that decade would go to the affluent elderly. At the same time, his proposal for draconian 30 percent cuts over a decade on the $7 trillion safety net — Medicaid, food stamps and the earned-income tax credit — is another front in the G.O.P.'s war against the 99 percent.

Without any changes, over the next decade or so, the gross federal debt, now nearly $17 trillion, will hurtle toward $30 trillion and soar to 150 percent of gross domestic product from around 105 percent today. Since our constitutional stasis rules out any prospect of a "grand bargain," the nation's fiscal collapse will play out incrementally, like a Greek/Cypriot tragedy, in carefully choreographed crises over debt ceilings, continuing resolutions and temporary budgetary patches.

The future is bleak. The greatest construction boom in recorded history — China's money dump on infrastructure over the last 15 years — is slowing. Brazil, India, Russia, Turkey, South Africa and all the other growing middle-income nations cannot make up for the shortfall in demand. The American machinery of monetary and fiscal stimulus has reached

its limits. Japan is sinking into old-age bankruptcy and Europe into welfare-state senescence. The new rulers enthroned in Beijing last year know that after two decades of wild lending, speculation and building, even they will face a day of reckoning, too.

THE state-wreck ahead is a far cry from the "Great Moderation" proclaimed in 2004 by Mr. Bernanke, who predicted that prosperity would be everlasting because the Fed had tamed the business cycle and, as late as March 2007, testified that the impact of the subprime meltdown "seems likely to be contained." Instead of moderation, what's at hand is a Great Deformation, arising from a rogue central bank that has abetted the Wall Street casino, crucified savers on a cross of zero interest rates and fueled a global commodity bubble that erodes Main Street living standards through rising food and energy prices — a form of inflation that the Fed fecklessly disregards in calculating inflation.

These policies have brought America to an end-stage metastasis. The way out would be so radical it can't happen. It would necessitate a sweeping divorce of the state and the market economy. It would require a renunciation of crony capitalism and its first cousin: Keynesian economics in all its forms. The state would need to get out of the business of imperial hubris, economic uplift and social insurance and shift its focus to managing and financing an effective, affordable, means-tested safety net.

All this would require drastic deflation of the realm of politics and the abolition of incumbency itself, because the machinery of the state and the machinery of re-election have become conterminous. Prying them apart would entail sweeping constitutional surgery: amendments to give the president and members of Congress a single six-year term, with no re-election; providing 100 percent public financing for candidates; strictly limiting the duration of campaigns (say, to eight weeks); and prohibiting, for life, lobbying by anyone who has been on a legislative or executive payroll. It would also require overturning Citizens United and mandating that Congress pass a balanced budget, or face an automatic sequester of spending.

It would also require purging the corrosive financialization that has turned the economy into a giant casino since the 1970s. This would mean putting the great Wall Street banks out in the cold to compete as at-risk free enterprises, without access to cheap Fed loans or deposit insurance. Banks would be able to take deposits and make commercial loans, but be banned from trading, underwriting and money management in all its forms.

It would require, finally, benching the Fed's central planners, and restoring the central bank's original mission: to provide liquidity in times of crisis but never to buy government

debt or try to micromanage the economy. Getting the Fed out of the financial markets is the only way to put free markets and genuine wealth creation back into capitalism.

That, of course, will never happen because there are trillions of dollars of assets, from Shanghai skyscrapers to Fortune 1000 stocks to the latest housing market "recovery," artificially propped up by the Fed's interest-rate repression. The United States is broke — fiscally, morally, intellectually — and the Fed has incited a global currency war (Japan just signed up, the Brazilians and Chinese are angry, and the German-dominated euro zone is crumbling) that will soon overwhelm it. When the latest bubble pops, there will be nothing to stop the collapse. If this sounds like advice to get out of the markets and hide out in cash, it is.

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Barra®

Introduction to risk modeling

We define risk as the uncertainty or volatility of investment returns. Within a portfolio, clearly understanding co-movements or covariances across positions is critical to managing portfolio risk. From experience we know that choosing names from closely related industries increases portfolio risk by concentrating your portfolio, while selecting investments that do not move perfectly together diversifies and reduces portfolio risk. We can use this insight to build a model that helps us robustly capture asset relationships. This paper provides the foundation for understanding how Barra's models arrive at their industry-standard risk forecasts. This document covers:

- The traditional approach for measuring portfolio risk
- Forecasting risk
- Portfolio management with factor models
- Barra's multiple-factor approach
- Appendix: Mathematical treatment of calculating risk

The traditional approach for measuring portfolio risk

A simple risk measure is the realized or historical volatility of returns over time. To estimate realized or historical risk for an asset, we need only a history of its observed returns, usually over a three- to five-year period. From this data, we can calculate the volatility of an individual asset as the standard deviation or dispersion of its returns.

To calculate portfolio volatility, we can use the volatilities of positions in the portfolio and the relationships between positions. By using the portfolio's positions to calculate risk, we gain additional flexibility to determine which position contributes the greatest amount of risk and to model paper portfolios and new funds with short histories.

We use correlation to describe the relationship between the returns of two assets. Assets that are highly correlated, such as two names in the same industry, concentrate portfolio risk. Assets that exhibit less than perfect correlation diversify portfolio risk, for example Airlines and Clothing Manufacturers. Correlations can have a large impact on portfolio risk, and, properly managed, can theoretically reduce a portfolio's volatility to zero.

Clearly, robust measures of asset volatilities and correlations are critical to portfolio risk analysis. The traditional approach to estimating this data is to rely on a defined history of asset returns. Although convenient, this method is not without its challenges, several of which are outlined below. Risk models, such as those delivered by Barra, overcome these challenges.

Challenge #1: Having a lot of data to work with complicates the problem.

For every asset in the portfolio we need to calculate volatility, and for each pair of assets we require correlation. Table 1 illustrates the calculations required for a three-asset portfolio: a volatility estimate for each of the three assets and three correlations, for a total of six calculations.

Table 1. Calculating risk for a three-asset portfolio requires three volatility estimates and three correlation estimates. The correlation between Asset 1 and Asset 2 is identical to the correlation of Asset 2 and Asset 1.

	Asset 1	Asset 2	Asset 3
Asset 1	risk	correlation	correlation
Asset 2	correlation	risk	correlation
Asset 3	correlation	correlation	risk

The number of calculations quickly grows as we add more assets. For a portfolio of 50 names, we would need to calculate 50 volatilities and 1,225 correlations. A portfolio of 1,000 names requires 1,000 volatility estimates and nearly 500,000 correlations.[1]

Calculating this much data is relatively simple given modern computing power. However, to achieve statistically robust estimates, we require a substantial history of returns; for example, to calculate correlations for 1,000 assets, we would need data for at least 1,000 periods for each asset. With monthly or weekly horizons, such a long history may not exist for every asset.

To be able to estimate risk for all assets in our universe, we need to develop a risk forecast that relies less on extensive asset return histories for every asset.

Challenge #2: Asset correlations aren't always insightful.

Suppose we observed the following:

- An Airline company's stock price plummets as a result of labor disputes.
- A poorly received fashion innovation depresses a Clothing manufacturer's performance.

If both companies experienced a downturn at the same time, we would find a strong correlation between them during that period. There is no intuitive economic relationship that would imply that these companies should be related; rather what we observe is a spurious consequence of the data. With large numbers of asset correlations to estimate, we face a greater likelihood of coming across such coincidental correlations between pairs of assets.

These correlations also run the risk of being volatile. If the fashion industry suddenly favors our Clothing manufacturer's designs, yet the Airline has not yet recovered, the correlations between the companies would change. Again, there is no intuitive economic reasoning to expect that their relationship is now different; the volatility of the correlation between these two companies is a purely random result. When we extend this randomness across thousands of observations, we obtain an unstable and meaningless risk measurement.

To ensure the robustness of our risk measurement, we would like to take advantage of economic intuition to estimate more realistic and stable correlations.

Challenge #3: Data based solely on historical observations does not always help us in the future.

Historic measures of risk tell us what happened over a past period. While useful by themselves, relying solely on them to better manage a portfolio over the coming period is analogous to driving a car while looking solely out the rearview mirror. Historic data might reflect stale market information, or we might miss information due to an insufficient history of returns.

Ideally we would like a measure that helps us estimate the risk expected in the future.

Forecasting risk

Risk forecasts, such as those provided by Barra, estimate the expected volatility over a coming period. To review the conclusions from our challenges, we would like to calculate risk while:

- Not relying on the availability of an extensive return history for every asset in our universe
- Taking advantage of economic intuition to measure realistic and stable correlations across our investment universe
- Estimating the expected risk for the coming period

To meet these requirements, we must combine historical return observations with additional information that reflects the current state of an asset or of the market. Our solution is to estimate asset volatilities and correlations indirectly by observing them through common themes in the market. While on the surface this proposition seems complicated, we already have a practical understanding of how this might work.

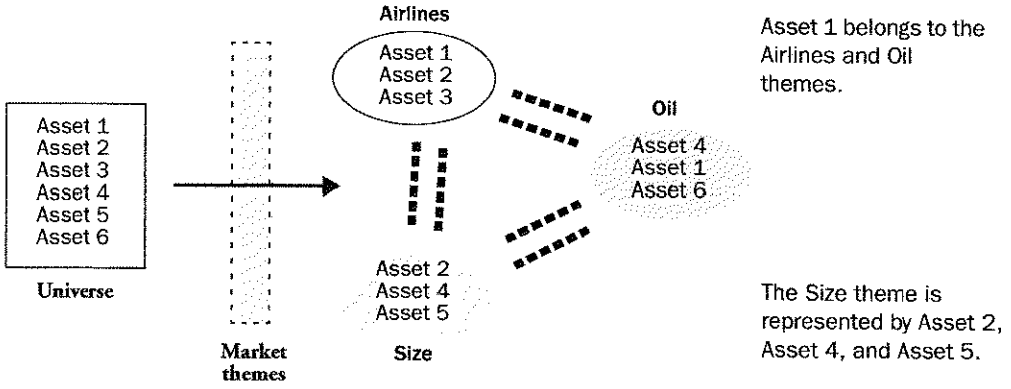
Estimating asset relationships through market themes

Market themes are regularly used to summarize the aggregate behavior of a group of assets. For example, we might observe that:

- Airline and Oil companies tend to move together.
- Market capitalization (Size) influences return.
- Debt credit quality affects volatility.
- European markets are strongly correlated with each other.

In fact, we can identify a relatively small number of *themes* that explain the behavior of a large number of assets. Figure 1 illustrates how we can visualize themes present in a universe of assets.

Figure 1. Visualizing market themes. We have identified three market themes in this six-asset universe.



Using themes allows us to find a solution to each of our previous challenges. First, using a smaller number of market themes instead of a large number of individual assets reduces the number of correlations we must estimate. Instead of estimating volatilities and correlations for every asset in our universe, we can estimate a smaller number of theme volatilities and correlations to summarize asset behavior.

This also allows us to minimize the impact of spurious correlations and to produce more stable forecasts. This is because we observe themes through the aggregate behavior of many assets; the impact of idiosyncratic changes in any one asset will have a minimal impact on our theme-wide volatility and correlation estimates.

Carefully selecting themes for our model will also allow us to control how correlations between assets present themselves. We can ensure that any commonality between assets comes only through themes that we feel are believable, stable, and meaningful. The portion of asset behavior that is not tied to these themes is assumed to be specific to that company, and not related to the company-specific behavior of other companies. This will further allow us to minimize the impact of spurious correlations.

Multi-factor models and risk forecasts

By using market themes to estimate risk, we have built a **multiple-factor risk model**. *Fundamental* multiple-factor models feature economically intuitive themes or *factors* based on market, fundamental, or technical data. This allows us to extend the use of our risk forecast from simply telling us our expected level of risk to helping us understand where it is coming from and what actions should be taken to bring the portfolio into alignment.

To build a fundamental model, we must first identify which themes are important in characterizing the behavior of securities. Robust models feature durable themes that are important for the current horizon and remain valid across market regimes. Once the themes have been identified, we can begin estimating our model. Figure 2 describes the model estimation process.

Figure 2. The model estimation process.

Step 1: Find asset exposures

Map each asset's current characteristics into themes such as industry membership. This is quantified as an **exposure.** We can calculate a portfolio's exposure to each factor as the portfolio-weighted average of its underlying assets' exposures.

Step 2: Calculate factor volatilities

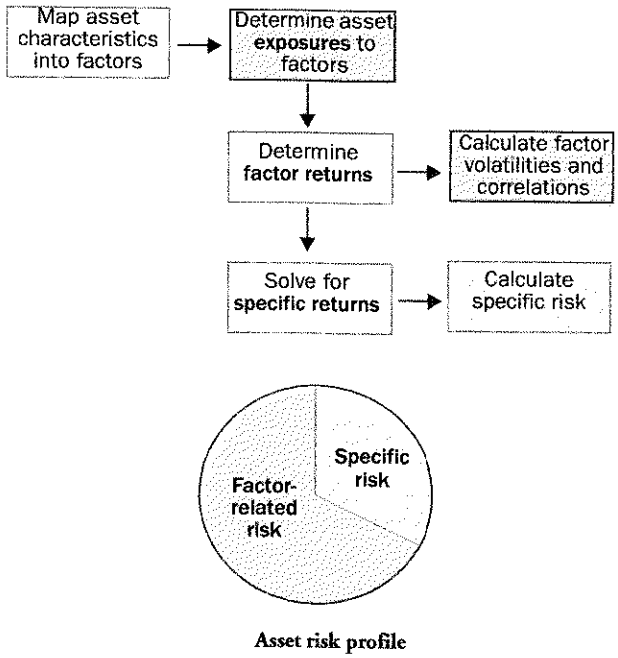
Calculate the return of each theme over each period using econometric techniques. From this history of **factor returns**, calculate the volatility and correlations of each factor.

Step 3: Determine specific return and risk

Find the portion of return that is not captured by these factors. **Specific return** is idiosyncratic and unique to each security. The specific risk of each security is assumed to be uncorrelated with the specific risks of all other securities.

Step 4: Calculate risk

An asset or portfolio's risk is a combination of factor-related and specific risks, derived from steps of our model estimation process.



With this information, we can calculate an asset's risk as a combination of factor-related risk and specific risk. Factor-related risk is due to the asset's exposure to each factor, the volatility of each factor, and the correlations between factors.

We can calculate a portfolio's risk in a similar manner, substituting portfolio-level exposures for asset-level exposures.

Why are fundamental models useful?

Fundamental factor models use the current characteristics of each asset, such as industry membership, to determine how each asset relates to the themes identified. The volatilities and correlations of the factors themselves are estimated using data from a cross-section of assets over a lengthy history. As a result, these models provide timely, stable, and robust risk estimates for both existing and new assets without requiring an extensive history of asset returns.

Final notes about multiple-factor models

There are several important points to keep in mind about multiple-factor models:

- The factors are **common** for all assets in our universe. All assets are exposed to all factors (even if they have a zero exposure).
- Each common factor **contributes** to a security's risk through a combination of the asset's sensitivity or exposure to that factor, the factor's risk, and the correlation between that factor and others.
- Most of any security's volatility will be explained by its specific risk. When combined into a portfolio, specific returns tend to diversify away, allowing common factors to more fully describe the portfolio's risk.

Portfolio management with factor models

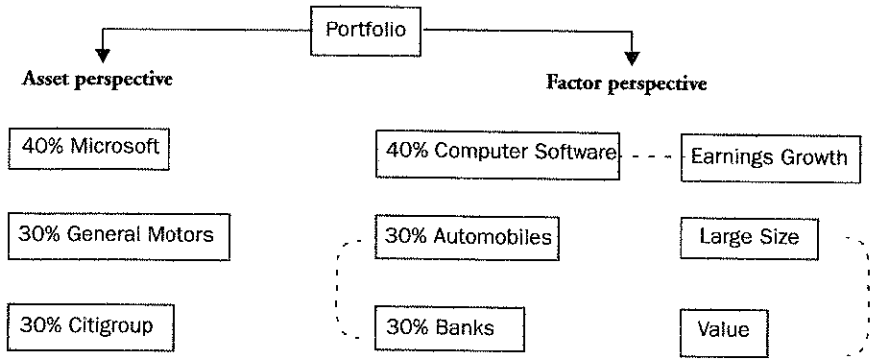
A portfolio's return is due to a combination of asset returns represented by its investment in those assets. We can generalize that portfolio risk comes from:

- Our position in each asset
- The volatility of each asset
- The correlations between each pair of assets

In this traditional framework, we manage risk by controlling both the portfolio's investment in each asset and the correlations between assets.

From a different perspective, we might view our portfolio as an investment in factors (in addition to being an investment in assets). For example, by investing in Microsoft, we are also investing in themes such as largecap companies, growth companies, computer software companies, and U.S. companies. Therefore, an asset investment is also a factor investment, and we can express portfolio return as a combination of the returns of those factors. Portfolio exposures (or weights) represent "investments" in factors. Figure 3 illustrates this concept.

Figure 3. Asset and factor perspectives on portfolio investments. The factor perspective presents a clearer view of the relationships present in the portfolio.



Extending this analogy we can alternatively view portfolio risk as the result of interactions between:

- Our position in each factor, or our factor exposure
- The volatility of each factor
- The correlations between each pair of factors

In this factor framework, we manage risk by managing asset positions *and* by controlling the portfolio's investment in each common factor. If we also understand and take advantage of the correlations between factors, we can balance individual asset selection decisions with a powerful, independent perspective on the driving forces behind our portfolio's risk profile.

There is one portion of risk not captured by common factors: idiosyncratic, or specific, risk. In our example, our investment in Microsoft is also an investment in the company's management team. This characteristic of Microsoft is not broad enough to be applied to companies across our investment spectrum, and as a result, is not explained by our common factors.

Barra's multiple-factor approach

Barra builds fundamental multiple-factor models for numerous equity and fixed income markets around the world. The results, along with a currency risk model, are then aggregated into the Barra Integrated Model offering both the breadth required for global analysis and the depth required for local drilling down.

Equity models

Barra's equity models forecast risk for individual countries or for entire regions such as Europe. Each model features two types of factors: styles (risk indices) and industries. Style factors are created from combinations of fundamental and market data called descriptors. Descriptors are aggregated to create an exposure to the style factor. Industry factors are based on industry assignments for each asset. Some markets offer sufficient data to allow an asset to be assigned to multiple industries. Barra's flagship model for U.S. equities currently features 68 common factors and covers over 10,000 securities.

Individual models are combined in the Barra Integrated Model, which in aggregate covers several thousand factors.

Fixed income models

Barra's fixed income models forecast risk for individual countries and, once aggregated, for global portfolios. Each model features two types of factors: term structure factors and spread factors. Term structure factors capture interest rate risk and are measured as the sensitivity of fixed income instruments to predefined movements in the local term structure, such as a shift, twist, or butterfly. Spread factors capture credit risk and are based on sensitivities to movements in the swap curve. Some markets offer sufficient data to allow for a detailed sector-by-rating classification scheme. Individual models are combined in the Barra Integrated Model.

Conclusion

In today's investment universes of thousands of assets, effectively measuring the correlations between assets is both a data and statistical challenge. Common factors based on identifiable market themes allow us to reduce the information contained in thousands of asset correlations into a smaller number of believable and robust relationships. Risk models, such as those provided by Barra, use common factors to estimate expected risk, helping practitioners better understand the influences of risk on their portfolios.

Appendix: Mathematical treatment of calculating risk

For a two-asset portfolio, we can express portfolio return mathematically as:

$$r_p = h_1 r_1 + h_2 r_2$$

where

r_p = return of the portfolio

h_i = weight of asset i

r_i = return of asset i

We can express portfolio risk as:

$$\sigma_p^2 = h_1^2 \sigma_1^2 + h_2^2 \sigma_2^2 + 2 h_1 h_2 \rho_{1,2} \sigma_1 \sigma_2$$

where

σ_i = standard deviation of asset i

$\rho_{i,j}$ = correlation between the returns of assets i and j

It is also useful to know that $\rho_{i,j}\sigma_i\sigma_j = covariance(i,j) = cov_{i,j}$.

For a three-asset portfolio, our expressions become:

$$r_p = h_1 r_1 + h_2 r_2 + h_3 r_3$$

$$\sigma_p^2 = h_1^2 \sigma_1^2 + h_2^2 \sigma_2^2 + h_3^2 \sigma_3^2 + 2 h_1 h_2 \rho_{1,2} \sigma_1 \sigma_2 + 2 h_1 h_3 \rho_{1,3} \sigma_1 \sigma_3 + 2 h_2 h_3 \rho_{2,3} \sigma_2 \sigma_3$$

We can summarize our equation for a three-asset portfolio's risk with matrices:

$$\sigma_p^2 = \begin{bmatrix} h_1 & h_2 & h_3 \end{bmatrix} \begin{bmatrix} \sigma_1^2 & \text{cov}_{1,2} & \text{cov}_{1,3} \\ \text{cov}_{2,1} & \sigma_2^2 & \text{cov}_{2,3} \\ \text{cov}_{3,1} & \text{cov}_{3,2} & \sigma_3^2 \end{bmatrix} \begin{bmatrix} h_1 \\ h_2 \\ h_3 \end{bmatrix} = \mathbf{hVh}^T \quad (1)$$

where

$\mathbf{h}$ = matrix of all portfolio position weights

$\mathbf{V}$ = matrix containing all asset variances and covariances

A single-factor model: the market

The simplest factor model is based on a single factor, where the factor is the market's movement, and beta describes the relationship between market movements and security returns. An asset with a large beta has a greater exposure to market movements than one with a smaller beta. There is still a portion of return not captured by the market factor that is residual, or unique, to that security.

We can express this mathematically as:

$$r_i = \beta_i r_{market} + r_{i,residual}$$

where

r_i = return of asset i

β_i = beta of asset i

r_{market} = return of the overall market

$r_{residual}$ = residual return of asset i net of any market influences

From a risk perspective,

$$\sigma_i^2 = \beta_i^2 \sigma_{market}^2 + \sigma_{i,residual}^2$$

where

σ_i	=	risk of asset i
σ_{market}	=	risk of the overall market
$\sigma_{residual}$	=	residual risk of asset i, or its risk net of the market's influence

Including additional factors for a multiple-factor model

We can identify additional themes that drive market behavior beyond the market's overall movement itself and arrive at a multiple-factor risk model. In fundamental multiple-factor models, these factors are correlated. As a result, we will also need to consider the covariances between each factor in our framework.

For a model with two factors, we can express an asset's return as:

$$r_i = x_{i,f_1} f_1 + x_{i,f_2} f_2 + u_i$$

where

r_i	=	return of asset i
$x_{i,fk}$	=	exposure of asset i to factor k
f_k	=	rate of return of factor k
u_i	=	specific return of asset i

An asset's risk in this two-factor model can be written as:

$$\sigma_i^2 = x_{i,f_1}^2 \sigma_{f_1}^2 + x_{i,f_2}^2 \sigma_{f_2}^2 + 2x_{i,f_1} x_{i,f_2} \rho_{f_1,f_2} \sigma_{f_1} \sigma_{f_2} + u_i^2$$

where

σ_{fk}	=	volatility of factor k
$\rho_{fk,fm}$	=	correlation between the returns of factors k and m
u_i^2	=	specific variance of asset i

This expression can be summarized with matrix notation as:

$$\sigma_i^2 = \begin{bmatrix} x_{i,f_1} & x_{i,f_2} \end{bmatrix} \begin{bmatrix} \sigma_{f_1}^2 & \text{cov}_{f_1,f_2} \\ \text{cov}_{f_1,f_2} & \sigma_{f_2}^2 \end{bmatrix} \begin{bmatrix} x_{i,f_1} \\ x_{i,f_2} \end{bmatrix} + u_i^2 = \mathbf{XFX}^{\mathbf{T}} + \Delta \qquad (2)$$

where

$\mathbf{X}$	=	exposure matrix of all assets to all factors
$\mathbf{F}$	=	variance-covariance matrix of all factor returns
Δ	=	matrix of specific variances

By including asset holdings, we can write portfolio return and risk in terms of our two-factor model. For a two-asset portfolio in a two-factor model, portfolio return can be written as:

$$r_P = h_1 x_{1,f_1} f_1 + h_2 x_{2,f_1} f_1 + h_1 x_{1,f_2} f_2 + h_2 x_{2,f_2} f_2 + h_1 u_1 + h_2 u_2$$

Portfolio return is the sum of the factor contributions and specific return contributions of each position. The factor contributions are a function of the position in each asset, the exposure of the asset to each factor, and each factor's return.

$$\sigma_P^2 = \begin{bmatrix} h_1 & h_2 \end{bmatrix} \left(\begin{bmatrix} x_{1,f_1} & x_{1,f_2} \\ x_{2,f_1} & x_{2,f_2} \end{bmatrix} \begin{bmatrix} \sigma_{f_1}^2 & \text{cov}_{f_1,f_2} \\ \text{cov}_{f_1,f_2} & \sigma_{f_2}^2 \end{bmatrix} \begin{bmatrix} x_{1,f_1} & x_{2,f_1} \\ x_{1,f_2} & x_{2,f_2} \end{bmatrix} + \begin{bmatrix} u_1^2 & 0 \\ 0 & u_2^2 \end{bmatrix} \right) \begin{bmatrix} h_1 \\ h_2 \end{bmatrix}$$

Portfolio risk is a function of the risk of each asset, the correlation of each asset, and the investment in each asset. The risk and correlation of each asset are determined by the factor exposures of each asset to each factor and the correlations between factors.

Our expressions for portfolio return and risk can be summarized as:

$$r_P = \sum_{k=1}^{K} x_{Pk} f_k + \sum_{i=1}^{N} h_i u_i$$

where

$x_{pk} = \sum_{i=1}^{N} h_i x_{ik}$ (the weighted average of asset-level exposures), and

$$\sigma_p^2 = \mathbf{h}(\mathbf{X}\mathbf{F}\mathbf{X}^{\mathrm{T}} + \Delta)\mathbf{h}^{\mathrm{T}} \quad .$$

This equation matches our asset-level risk model (Equation 1). The expression at the center substitutes factors relations for asset-level variance and covariances (Equation 2).

1. In general, for a universe of n assets, we would need to find $\frac{n(n-1)}{2}$ correlations.

WELLINGTON MANAGEMENT

NOVEMBER 2012

VIEWPOINTS

Is Parity Passé? A Better Way to Balance Risk

By

Steve Gorman, CFA
Portfolio Manager and Director, Tactical Asset Allocation

INSIDE

Many investors believe their asset allocation policies failed them over the past decade. Living with a long investing horizon and the associated emphasis on higher-risk or lower-liquidity investments proved difficult when market storms did not subside quickly. Portfolios thought to be well diversified did not offer sufficient downside protection, as the final years of the Great Moderation exposed the vulnerability of traditional asset mixes dominated by equity risk. In a portfolio with a 60% equity/40% bond split, for example, more than 95% of the risk comes from the equity allocation — a result of equities being much more volatile than bonds (**Figure 1**).

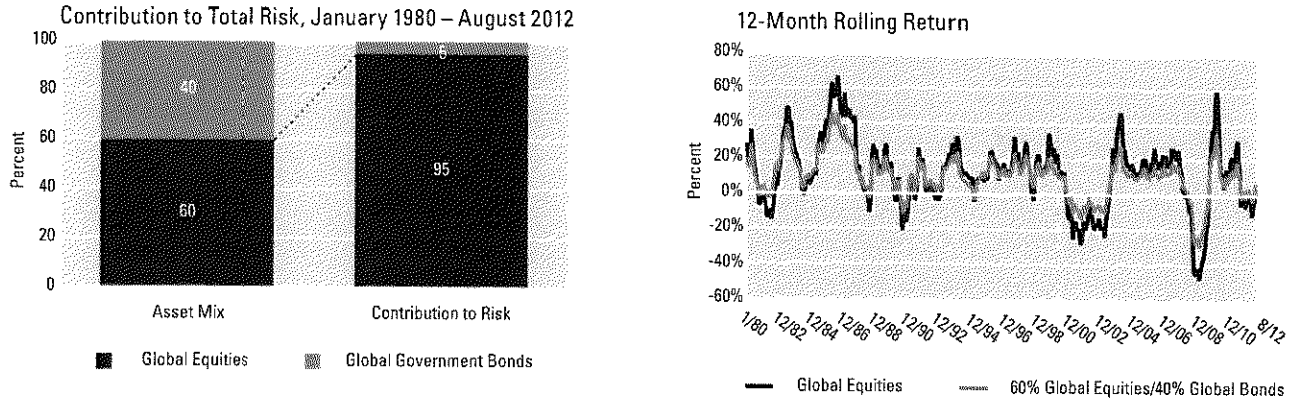
As a result, investors have been drawn to risk-parity strategies in recent years, with the idea that providing a more balanced distribution of risk contributions from each asset class should result in more consistent outcomes across different market environments. Risk-parity strategies combine principles from investment theory, risk budgeting, and robust optimization to give investors a "full tool kit" alternative to traditional asset allocation strategies. There is, however, no universal definition of risk parity. Some managers allocate risk across assets, while others allocate risk across economic regimes or risk factors. Managers vary the number of assets included and the way assets are grouped. They also rely on different investment processes. Some take a more strategic approach, building a portfolio on the basis of long-term expectations for volatility and an assumption of identical return per unit of risk across asset classes. Others proceed with similarly low emphasis on return forecasts, but adjust volatility and/or correlation estimates as the market environment changes.

We believe that risk parity, broadly speaking, is a sensible approach to asset allocation. In our view, however, there are shortcomings in what might be termed traditional risk parity. These include "passive" or hands-off implementation strategies, static beta exposures, and risk-budgeting decisions based on volatility, correlation, and risk-adjusted return assumptions that do not respond to market dynamics. The alternative we advocate is a more active approach to risk parity — one that combines structural allocations predicated on long-horizon research with tactical opportunities to boost return and manage risk. Specifically, we embrace these ideas:

- Risk parity should balance exposures across asset classes, economic environments, and other risk dimensions.
- The principle of balance should apply not only at the asset-class or aggregate level but at the sub-asset-class level as well.
- Portfolio construction should be dynamic, evolving with markets, responding to return opportunities, and incorporating timely risk hedges.
- Volatility should be managed to a constant target, redistributing portfolio exposure over time to more fertile risk-adjusted return categories and helping to mitigate drawdowns.

Figure 1

Traditional Balanced Portfolios Are Dominated by Equity Risk



Global equities are represented by the MSCI All-Country World Index and global bonds by the Citigroup World Government Bond Index (hedged).
Sources: MSCI, Citigroup, Wellington Management

The Evolution of Risk Parity

To put our approach in perspective, it is helpful to first examine the roots of the search for risk balance. They can be traced to the late 1920s launch of the Wellington Fund, the first mutual fund to combine stocks and bonds in an effort to produce a balanced investment outcome. As the Great Depression soon demonstrated, however, conventional balanced portfolios still have relatively high sensitivity to equity-market performance. The development of modern portfolio theory was the next step on the path to risk parity — specifically the pioneering work of Markowitz on portfolio selection in the 1950s and the work of Treynor, Sharpe, and others on the Capital Asset Pricing Model during the 1960s and 1970s. The results of this research included the portfolio-volatility calculation so fundamental to portfolio construction today and the notion that leveraging the global market portfolio represents the most efficient solution for investors with a higher risk tolerance. During the years that followed, investors in search of better-diversified portfolios increasingly turned to portfolio optimization and efficient frontiers. Unfortunately, instead of achieving portfolio balance, they too often found these optimized solutions to be error maximizing — highly sensitive to correlation, volatility, and, in particular, return assumptions.

The quest for a truly balanced portfolio continued, and in the 1990s the concept of risk budgeting began to gain traction. This involved building portfolios on the basis of risk allocations, thereby reducing or eliminating the role of return forecasts. It also involved treating alpha and beta as distinct elements in the portfolio-construction process. The increasing availability of leverage, derivatives, and computing power facilitated the process. The first risk-parity strategy was launched in the latter half of the 1990s, balancing risk contributions across economic environments. Investors were slow to embrace the idea, due perhaps to lagging performance of risk-parity strategies during the final years of the equity bull market, a reluctance to abandon the efficient-frontier framework, or an aversion to leverage and derivatives. But the turbulence of the early 2000s helped validate the concept and the second generation of risk-parity strategies appeared a few years later. The global financial crisis provided further evidence of the virtues of portfolio balance, as did the risk-on/risk-off behavior that has characterized financial markets over the last few years.

Today, institutional investors are implementing risk parity in a variety of ways. Some include it within their global tactical asset allocation (GTAA) or alternatives bucket, while others shift assets from stocks or a blend of stocks and bonds. Still others apply risk-parity principles at the total portfolio level.

Over time, it seems likely, and advisable, that investors will increasingly consider risk parity as a core allocation, acknowledging both the balance endemic to the approach and the challenge of sticking to the "stocks for the long run" mantra through protracted periods of uncertainty and economic weakness like the current one. However, in order for risk parity to be embraced more broadly, the concept and its implementation must continue to evolve, as they have in our own portfolio.

Next-Generation Risk Parity

Our risk-parity philosophy differs from traditional approaches along several dimensions, including structural allocations, optional use of alternative betas, customized asset-class implementation, and dynamic volatility control.

Structural Allocations

The term risk parity naturally creates an expectation of equal risk allocations. That is, assuming that Sharpe ratios are equal across investments and that leverage can make these investments fungible leads one to expect an equal-risk-weighted position in each investment. In practice, however, risk balanced probably would be a better category label. Any notion of equal risk allocation depends on the delineation of the buckets designated to receive an allocation. Should the buckets be defined in terms of broad asset classes such as bonds? Should bonds be split into nominal, inflation-linked, and credit buckets? Should there be a distinction between US, non-US, and emerging market bonds? The reality is that the answers will vary widely among managers in this space and that managers do not allocate risk equally across any common set of buckets, be they asset- or risk-factor-based.

Equities: A Structural Cornerstone

In explaining our approach to structural allocations, we must revisit the assumption that Sharpe ratios are equal across investments. Among broad liquid asset classes today, equities offer the best prospects for attractive long-term real returns. Even at a discount to historical returns, equities provide access to real economic growth and dividends along with an intuitively appealing rationale for the persistence of a material risk premium. With bond yields at such low levels and the risk premium on inflation hedges like commodities and currencies ambiguous at best, it is reasonable to expect equities to produce the dominant Sharpe ratio over a long forecast horizon.

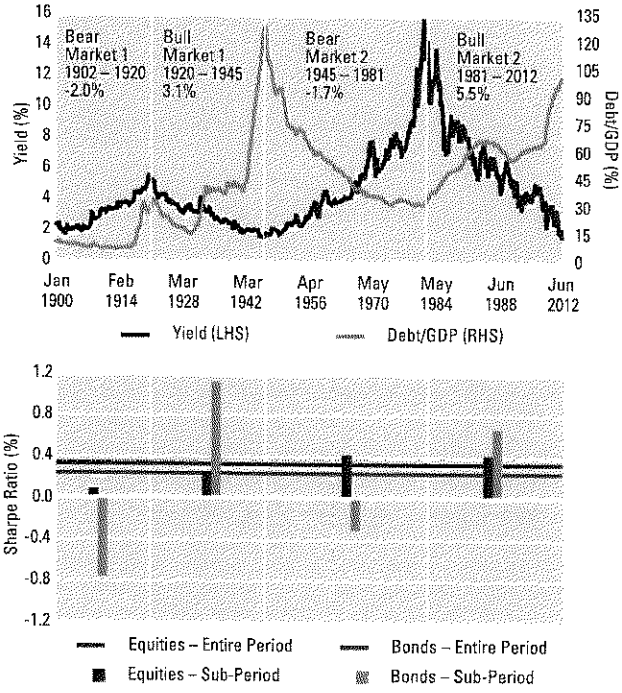
Figure 2 provides some perspective. US stocks and government bonds produced similar Sharpe ratios over the past century. But there were multi-decade periods of substantial variability in the Sharpe ratios of government bonds, driven by two lengthy interest-rate cycles. The 1900s began with a two-decade bear market during which bonds underperformed cash by 2% per year. This was followed by a 25-year rally during which bonds outperformed cash by 3% per year. The second cycle began following World War II and produced a 35-year bear market during which bonds underperformed cash again by almost 2% per year. The current bull market has lasted three decades with bonds outperforming cash by more than 5% per year. In contrast, the Sharpe ratio for equities during these four sub-periods remained relatively close to the long-term Sharpe ratio for equities.

Figure 2 highlights several points supporting the use of equities as the cornerstone of a risk-balanced portfolio. First, while the current bull market in bonds may persist a bit longer or yields may move into a lengthy rangebound phase, the best bond return years in this rate cycle likely are behind us. Second, the comparative stability of the equity Sharpe ratio during these rate cycles is appealing. Equities may remain modestly overvalued from a cyclically adjusted P/E perspective, but the revaluation risk, even when coupled with conservative real growth expectations, does not suggest that the long-term Sharpe ratio will be inconsistent with what we see in **Figure 2**. And so it makes sense to emphasize equities whether one believes that the long-term Sharpe ratio will be higher (after all, entry point is relevant even with a multi-decade horizon) or that the confidence interval accompanying a comparable Sharpe ratio expectation is tighter for equities than for other assets.

Figure 2

Sharpe Ratio Instability Over Bond Market Cycles

10-Year US Treasury Yield; Annual Excess Return Displayed for Each Market



Equities represented by S&P 500; bonds by 10-year US Treasuries
Source: Wellington Management

Treating equities as a cornerstone does not undermine the appeal of a risk-balanced portfolio. To moderate the inevitable pain associated with equity holdings during periods of distress, a properly balanced portfolio requires a sufficient number of "hedges" such that portfolio volatility is more controlled and risk-adjusted return is better than for equities alone. In particular, while **Figure 2** suggests that bond return expectations should be tempered relative to the recent past, government bonds should continue to play a prominent role as a recession and flight-to-quality hedge. And in thinking about the required allocation to government bonds, we should bear in mind two arguments for risk parity. First, traditional balanced-fund structures do not include enough bond exposure to provide any real protection during periods of equity-market turmoil. Second, forecasting returns is difficult and the future is uncertain (now more than ever). Market participants have been calling for yields to rise since early 2009, yet yields have continued to decline. The decade following World War II (**Figure 2**) serves as a reminder of how long a period of low yields can persist before moving meaningfully higher. US 10-year yields averaged 2.25% and remained within a +/-0.75% range from 1946 – 1955. This occurred against a backdrop of a deleveraging economy (working down a very high post-war debt-to-GDP ratio), intermittent high inflation and deflation, recessions and very strong growth, and international crises (the Korean War, the onset of the Cold War, and the Suez Crisis). While this historical window differs from today in many respects (e.g., the Fed was not independent until the Treasury/Fed Accord of 1951), it demonstrates how policy resolve can corral the bond market for a long time.

Parenthetically, if an asset class becomes very expensive to carry as a quasi-hedge from an expected return perspective, it may make sense instead to pursue more explicit hedging strategies. For example, a combination of equity puts, receiver swaptions, and short breakevens may be a sensible alternative to a portion of a long government bond allocation. In summary, while there is merit in anchoring a risk-parity portfolio to equities, other assets must play a meaningful supporting role, helping to smooth out performance during periods in which equities struggle.

Think Function, Not Form

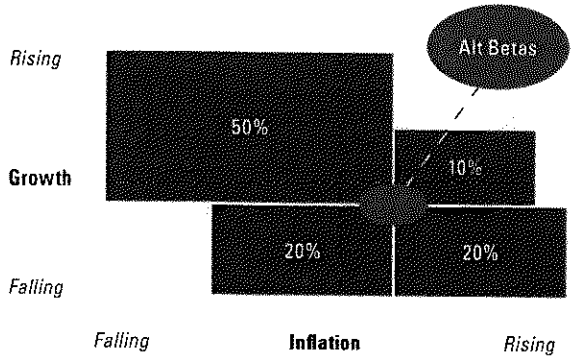
Asset class is but one lens through which to view the risks in a portfolio. Supplementing this with other lenses such as economic, market/fundamental, or statistical frameworks is an important part of ensuring balance. Using an economic lens, for example, we consider portfolio exposure to economic growth, recession, stagflation, and inflation — an approach we term "Think Function, Not Form." Each asset class has a primary role within this framework. Equity performance aligns most closely with periods of rising growth and falling inflation. Nominal government bond performance aligns most closely with periods of falling growth and falling inflation (a recession/depression/deflation hedge). Inflation-linked government bond and precious metal performance aligns most closely with periods of falling growth and rising inflation (a stagflation hedge). Finally, the performance of commodities and currencies (particularly commodity-sensitive currencies) aligns most closely with periods of rising growth and rising inflation (an inflation hedge).

Consistent with the points raised in the preceding sections, we believe that an appropriately balanced portfolio should have its largest risk allocation to the rising-growth/falling-inflation regime with smaller, supporting risk allocations to the other three regimes (**Figure 3**). The size of each risk allocation reflects our relative confidence in both the equality of Sharpe ratios across the asset classes associated with these economic regimes and the unique hedging attributes of each asset class. Importantly, when combined with the portfolio-construction techniques that will be discussed in the following pages, this risk allocation does not translate into a high correlation with broad equity or other markets.

Of course, there are limits to the explanatory power of macroeconomic risk models. The asset class/regime association is categorical (e.g., equities may perform well in both rising-growth states), can be time-period dependent (e.g., the energy sector can plot as an inflation or stagflation hedge depending on the type of inflation experienced at a given time), and may be only marginally distinct (e.g., common real rate exposure in nominal

Figure 3

Risk Targets by Economic State



Contribution to risk, asset classes mapped categorically to economic environment.

Source: Wellington Management

and inflation-linked bonds can pull the latter toward the weak-growth quadrant). Further, a simple approach might be to assign an equal 25% weight to each box in **Figure 3**, assuming an equal probability of each regime. We think it prudent, however, to consider that the US spent only 25% of the time from January 1900 to June 2012 in a recession, during which US government bonds outperformed US stocks by 10% per year (**Figure 4**). Stocks outperformed bonds by an identical 10% per year during the remaining 75% of that century-plus. The Sharpe ratios in **Figure 4** reflect these performance differences. So it is helpful to view economic regimes and the associated probabilities in different ways. But while one can vary asset classifications and regime definitions, "Think Function, Not Form" provides a straightforward, intuitive means of evaluating the role of each risk allocation.

Alternative Betas

Figure 3 also introduces the concept of alternative betas. We believe that a risk allocation to these less traditional exposures represents a valuable supplement to the core asset positions. Sometimes referred to as exotic betas, hedge fund replicating factors, or (paradoxically) compensated risk factors, these systematic sources of expected return derive from risk premia or behavioral biases. We summarize the alternative-beta opportunity set using five groups: carry, momentum, mean reversion, quality, and liquidity.

- **The carry group** includes what we view as "status quo" trades. For example, currency carry involves taking a long position in a high-yielding currency and financing that with a short position in a low-yielding currency — a bet against interest-rate parity. If the status quo is maintained and the exchange-rate depreciation does not offset the interest-rate differential, the trade is profitable. Of course, a fortuitous valuation change (in this case, a strengthening high-yielding currency) will provide this trade an additional boost. But these trades also can be regarded as "pancake" trades. They work most of the time but experience significant drawdowns during bouts of risk aversion. We deal with this negatively skewed profile by incorporating protective portfolio-construction measures to minimize the risk that the trade gets "flattened." A variety of short-volatility, spread, and carry trades share these characteristics and populate this group.
- **The momentum group** includes what we view as persistence or pro-sentiment trades. For example, taking a long position in an asset when its 50-day moving average is higher than its 200-day moving average or selling it when the opposite is true is classic trend-following behavior. Of course, divergence eventually begets reversal and rangebound markets challenge the time scale of momentum, so portfolio-construction safeguards make sense here too.

Figure 4

US Stock and Bond Performance Across Cycles

January 1900 – June 2012

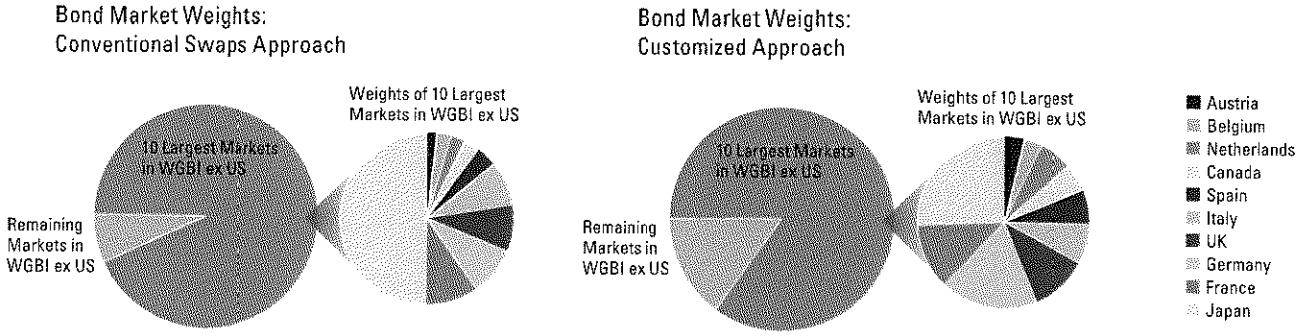
	Business Cycle Contraction			Business Cycle Expansion		
	Bonds	Stocks	*Difference*	Bonds	Stocks	*Difference*
Compound Return	6.2%	-3.8%	*10.0%*	4.5%	14.5%	*-10.0%*
Standard Deviation	6.6%	23.6%	*-17.1%*	5.4%	15.1%	*-9.7%*
Sharpe Ratio	0.4	-0.3	*0.7*	0.2	0.7	*-0.5*

National Bureau of Economic Research (NBER) recession dates
Source: Wellington Management

- **The mean-reversion group** includes a wide array of convergence or contrarian trades. For example, a volatility arbitrage trader may buy cheap implied volatility expecting it to return to a more normal level. Or a merger arbitrage trader may expect an announced deal to close and the share price of the target company to converge to the announced transaction price. These strategies share some notion of a return to fair value. We prefer to focus on relative value at the individual security level, where there is sufficient breadth to capture valuation discrepancies — via a long-only value emphasis with a market-beta hedge. Such an approach avoids the need to short individual stocks, as with merger arbitrage, and helps us manage the inconsistency associated with some top-down value strategies.
- **The quality group** encompasses what have been described as leverage-aversion trades. They exploit a higher Sharpe ratio associated with a seemingly less risky investment because investors eschew the leverage required to put the less risky investment on the same portfolio-impact footing as its more risky counterpart (typically within the same asset class). Buying low-beta stocks over high-beta stocks is an example of such a trade. Whether investors are pursuing higher growth expectations or conceding some effective premium for upside optionality, history indicates that the riskier group of stocks has generated less return per unit of volatility.
- **The liquidity group** includes trades targeting the premium paid to investors with longer holding periods who are willing to forego transaction ease. There is a wide spectrum of trades within this group and a number of considerations. Pursuing the small-cap premium clearly is a different proposition than a venture-capital investment, although both share a liquidity

Figure 5

Creating a Non-US Government Bond Portfolio



The customized approach to non-US government bonds on the right has broader market exposures than the conventional approach on the left: The 10 largest markets have a smaller overall weight (dark-green area) and Japan has a smaller weight (light-blue area) within the 10 largest markets.

Based on September 2012 weights of the Citigroup World Government Bond Index ex US (WGBI ex US)
Sources: Citigroup, Wellington Management

element. Position size is a factor, as is the time-varying nature of liquidity (which worsens exponentially during periods of stress). In addition, some of these trades are correlated with more liquid investments, so a purer representation would hedge these return components (e.g., a corporate bond devoid of its interest-rate and spread-duration exposure). Despite the caveats, the liquidity group captures a risk premium not significantly present in the core asset classes or other alternative beta groups.

While we find this classification scheme helpful, we acknowledge that it is not black and white. The small-cap premium has a default-risk element in addition to a liquidity component. Convertible arbitrage introduces liquidity risk. Merger arbitrage has some carry-group attributes as a market sell-off can scuttle a deal and result in a significant loss. Even traditional value trading can require patience and staying power, since misvaluation can persist for a long time resulting in some holding-period common ground with liquidity trades. For more detail on alternative betas, turn to page 11.

In our own approach, we focus on the first four alternative-beta groups (carry, momentum, mean reversion, quality) while avoiding the liquidity group due to our belief that a risk-parity portfolio should maintain accommodative dealing terms and represent a potential liquidity source during times of stress. We find the carry and momentum groups particularly appealing given the ease of trading and complementarity to the core asset classes.

Customized Asset-Class Implementation

Managers of risk-parity strategies often use exchange-traded funds, futures, and other conventional index representations when building their portfolios. We believe there are better ways to access each asset class — customized approaches designed to reduce concentration risk, increase Sharpe ratios, and ensure that each asset-class implementation is consistent with the governing principles of balance and downside-risk mitigation.

Take exposure to nominal non-US government bonds, for example. Conventional approaches include using equal-risk-weighted available bond futures (Germany, Japan, Canada, the UK, and Australia) or total-return swaps on the Citigroup World Government Bond Index ex US (WGBI ex US). Both are cost-effective means of accessing leverage. The former is exchange traded but includes a narrow set of markets, while the latter is over-the-counter but includes a broad set of markets. Importantly, both result in a concentrated position in Japanese government bonds — with futures due to Japan's low volatility and low correlation with other markets, and with swaps due to the large amount of outstanding government debt that drives the index weights.

Since the equal-risk-weighted approach is dependent on the number of markets that happen to offer futures, let's proceed with the WGBI ex US swaps approach as our basis for comparison. The left side of **Figure 5** shows the 10 largest market weights using the swaps approach, while the right side shows

an alternative approach that we have crafted to take into account not only the liquidity and economic significance of each market but also the quality of each market as measured by factors such as debt level. Japan's weight is much lower in this approach, dropping from almost 50% to less than half that. The result is a multi-dimensionally balanced government bond portfolio — a carefully tailored version of the equal-risk-weighted solution with a quality tilt and broader market exposure. At the same time, this implementation maintains the cost-effective profile of the conventional approaches, combining futures with forwards (or repurchase agreements) and, should financing costs become too high, physical bonds.

We advocate similarly thoughtful approaches to implementation of other asset classes, including inflation-linked bonds, equities, and commodities. Commodities implementation, for example, must address sector weighting, individual commodity weighting, and roll-yield management (not to mention a seemingly ever-increasing number of regulatory restrictions). Risk-parity principles should apply not just at the asset-class level but also at the implementation level. And these implementation decisions should combine volatility contribution management with other disciplines supporting Sharpe ratio enhancement, drawdown control, and overall portfolio balance.

Opportunistic Protection

We also believe implementation should incorporate opportunistic risk hedging. When protection costs are low, portfolio leverage is above average, or an asset class has enjoyed a very strong performance run, it may be wise to include option strategies to reduce downside risk. For example, a jittery equity market might offer cost-effective put spreads, providing protection against a 5% – 15% price decline. Such insurance policies often expire worthless, but that simply means the portfolio experienced no unpleasant surprises — a desirable outcome. No one wants to pay for car or homeowner insurance, but we certainly appreciate the protection when the unexpected occurs. The art is in balancing an assessment of the primary risks confronting the portfolio with the cost, potential payoff, and trading of hedging strategies. We believe that spending some option premium each year is a wise way to help manage drawdowns in a risk-parity portfolio.

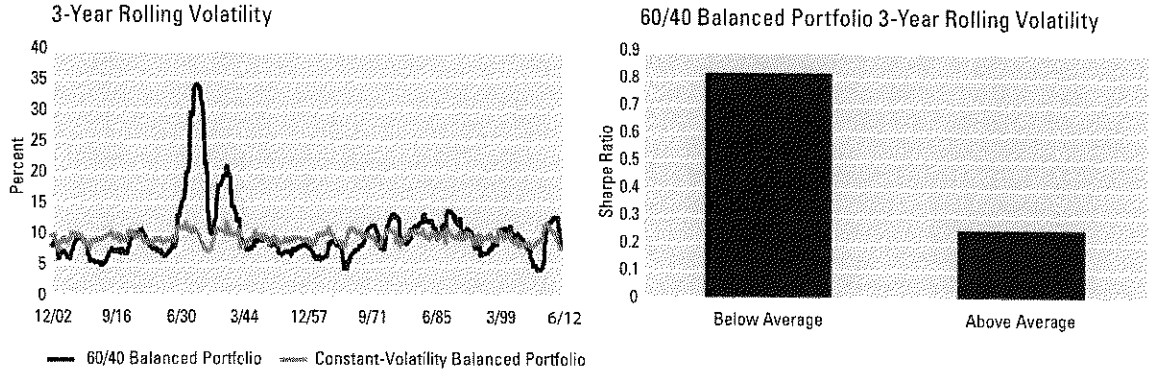
Such drawdown control has three potential benefits. First, it reduces the temptation to exit an investment at the worst time. Second, it reduces the required recovery return. A drawdown of 20% requires a 25% return to get back to neutral, whereas a 10% drawdown requires only an 11% return. Third, it may improve the compound return. Because the compound return is approximately equal to the average return minus half the return variance, and because lower drawdowns can reduce volatility, the compound return can increase even if the average return is unchanged.

Volatility Control and Downside Risk Management

Risk-parity managers must address two basic volatility questions in the portfolio-construction process. How will they manage the volatility contribution from each asset class, and how will they manage the volatility of the overall portfolio? Some managers adopt a more strategic approach using long-term assumptions and allowing both risk contributions and overall portfolio volatility to drift over time. Others adopt a more dynamic approach to control this drift. We fall in the latter camp and embrace the following portfolio-construction principles.

Figure 6

Volatilities of US 60/40 Portfolio and Constant-Vol Portfolio: A Comparison



Components of 60% equity/40% bond portfolio are S&P 500 and 10-year US government bonds.
Sources: Global Financial Data (GFD), Federal Reserve, Ibbotson Associates

- Forecasting volatility and correlation is a much more tractable problem than forecasting returns. Dynamic forecasts capture current market information and provide valuable portfolio construction direction.
- Focusing on volatility alone is insufficient. Understanding tail properties, such as drawdown distributions, portfolio skewness, and contribution to skewness, is an important part of the process.
- Having hard position limits on individual assets and the overall portfolio is prudent. Forecast error is a part of life.
- Having a clear ex-ante approach to managing drawdowns is valuable. The decision is made before emotion can become part of the equation.

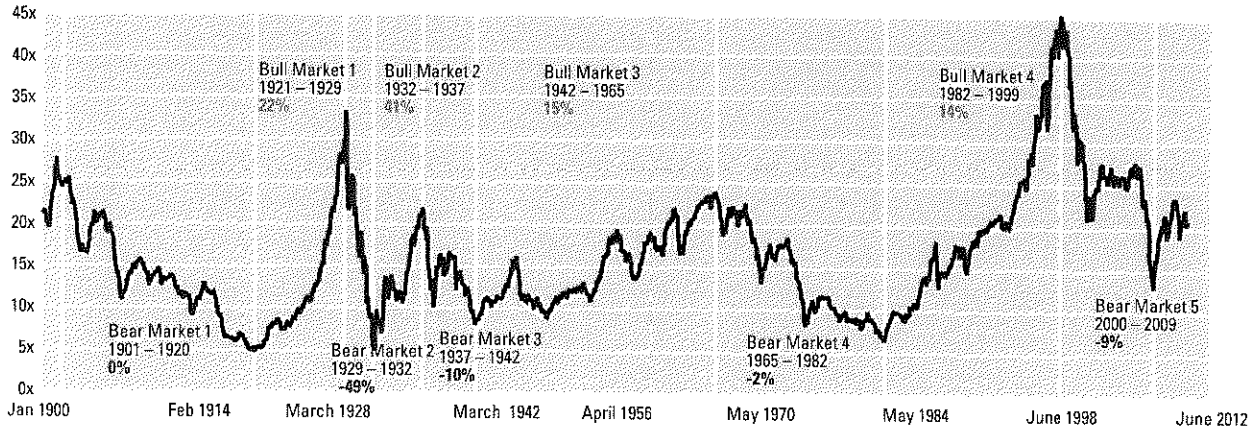
Let's look more closely at the first principle. We believe a risk-parity strategy should not only diligently control the risk contribution from each asset class but should also utilize a constant-volatility target for the overall portfolio. This requires a dynamic portfolio-construction process, incorporating daily updates of volatility and correlation projections for all asset classes. Consider **Figure 6**, which depicts the three-year rolling annualized volatility of a 60% US equity/40% US government bond balanced portfolio since 1900. The volatility ranged from a low of 4% to a high of 34% with a median of approximately 9%. On the other hand, using a straightforward volatility forecasting methodology (an exponentially weighted volatility calculation) for illustrative purposes, we can shrink the volatility range to 7% – 12% around a similar median volatility. This simple constant-volatility portfolio reduces exposure (raises cash) when expected volatility is above target and increases exposure (adds leverage) when expected volatility is below target. **Figure 6** demonstrates the feasibility of managing volatility — we see a significantly more controlled volatility experience. The 1930s are a bit scale-distorting, but they do punctuate the effectiveness of even basic volatility forecasts in controlling portfolio volatility. In addition, the balanced fund delivers a Sharpe ratio of 0.82 when volatility is below average and 0.25 when volatility is above average. By increasing exposure during quiet times and reducing exposure during turbulent times, the constant-volatility portfolio leans into higher Sharpe ratio periods and away from lower Sharpe ratio periods, essentially maintaining the same total weight as the balanced fund but redistributing that weight across time and volatility regimes.

There are a few things to bear in mind regarding a constant-volatility approach. The required trading is often momentum-oriented, so it is important to structure transactions in manageable increments using liquid futures contracts to minimize the call on market liquidity during heavy sell-offs. Constant-volatility management is not portfolio insurance. Its objective is to create a controlled return experience, not to produce an option-like payoff. Nor is constant-volatility management an alpha-generating process; it is more akin to a portfolio-rebalancing discipline — that is, it will trim incremental volatility whether that derives from a big down

Figure 7

Cyclically Adjusted P/E of Large-Cap US Stocks

January 1900 – June 2012; Annual Excess Return Displayed for Each Market



S&P 500 returns are a blend of Ibbotson and GFD data; earnings a blend of Shiller, GFD and S&P data; CPI a blend of FRED, Shiller and GFD data

Source: Wellington Management

day (momentum-like) or a big up day (mean reversion-like). Constant-volatility management should produce a slightly better Sharpe ratio over time, but this is a by-product of denominator control, not return enhancement. Finally, constant-volatility management often limits drawdowns (in this case, relative to a balanced portfolio) during the onset of a crisis but then gives back a portion of that relative performance when the recovery commences and strong positive performance coincides with continued elevated volatility.

Constant-volatility management is no panacea, but along with dynamic management of risk contributions and appropriate drawdown and turnover control measures, it represents an important part of a robust risk-parity portfolio-construction process.

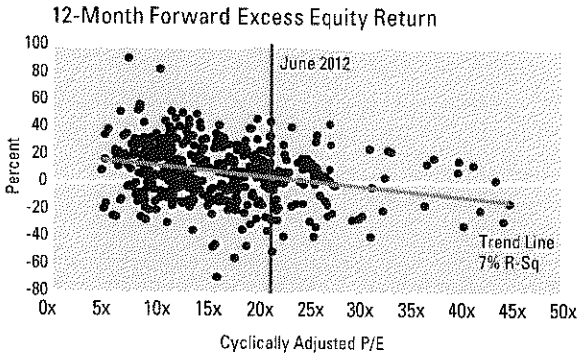
Active Management of Structural Targets

While many risk-parity approaches rebalance passively to long-term allocations, we believe that actively managing the structural exposures is important. As we noted earlier, Sharpe ratios vary over time and significant departures from even accurate structural assumptions can persist for many years. (Actively revisiting these strategic inputs also protects the portfolio from erroneous structural assumptions, such as those linked to practically unrealistic time horizons.) **Figure 7** shows the cyclically adjusted P/E ratio for large-cap US stocks over the last century. This period included five P/E troughs (bear markets) and four peaks (bull markets). The median bull market lasted 13 years, producing an 18% median annual return in excess of cash. The median bear market lasted 9 years, delivering a median annual excess return of -9%. The conclusion: entry point (valuation) matters and the opportunity exists to impact performance meaningfully by making informed adjustments to expected Sharpe ratios.

Of course, translating this opportunity into performance is not a given. **Figure 8** relates the cyclically adjusted P/E to subsequent 12-month equity market performance. The conditional averages in the lower table generally square with intuition. Lower P/Es correspond with performance that is significantly above average during the following year, while very high P/Es correspond with significantly negative performance. But the upper part of **Figure 8** reminds us that there is considerable volatility in the equity market, and the correlation between P/E and performance over the subsequent year is approximately 0.26. Valuation is important, but is not the only consideration. The technical structure of the market is relevant, as is the economic backdrop (growth, interest rates, inflation), risk appetite, and other factors. We believe that combining sound empirical research with experienced judgment offers the highest probability of active management success.

Figure 8

Predictive Value of Cyclically Adjusted P/E of Large-Cap US Stocks



Quintile	Max P/E	Average Forward Return	Standard Deviation	t-Statistic
1	10.5x	15%	26%	2.7
2	13.3x	13%	19%	2.6
3	17.4x	7%	22%	0.4
4	21.3x	5%	20%	-1.6
5	45.0x	-1%	19%	-4.2

Source: Wellington Management

Final Thoughts: Risk Parity in a Low-Rate World

The current low level of bond yields prompts some to dismiss risk-parity portfolios as leveraged bond plays — the implication being that these portfolios will print very negative returns should rates begin to rise. This is not necessarily the case. Remember, these portfolios were designed for long-term balance, so breaking down whenever rates rise would be wholly inconsistent with this objective. The outcome depends on relative Sharpe ratios. Today the correlation between stocks and bonds is very negative, as is the correlation between commodities and bonds. If this coincides with sufficiently positive Sharpe ratios for stocks and commodities as rates rise (improving growth and inflation expectations), an appropriately structured risk-parity portfolio will print a positive absolute return. In fact, this is the behavior we witnessed throughout the last decade during the handful of periods when bond yields rose significantly.

Of course, a risk-parity portfolio will underperform equity-heavy traditional balanced funds when bond returns turn south, so there may be some relative return regret. But this is less a failing of the structural balance of risk-parity portfolios and more a case of wanting to own more stocks when stocks perform well. There have been instances in which equity and/or commodity performance was negative or insufficiently positive to offset negative bond returns (e.g., 1981, 1994), but the negative returns to a typical risk-parity portfolio were relatively modest (low to middle single digits). The point is that rising rates obviously represent a headwind to risk-parity portfolio performance, but they do not guarantee negative performance and they do not obviate the need to maintain portfolio balance as rising rates also come with no guarantee of positive equity performance.

In the preceding pages, we also introduced a number of risk-parity portfolio features that would mitigate the effect of rising US bond yields.

- **Global interest-rate exposure** — While there is a global rate cycle, there also are diversification and return opportunities in non-US government bond markets. A significant risk allocation to and a well-balanced implementation within non-US government bonds can decrease portfolio vulnerability to a US rate rise.
- **Constant-volatility management** — If a rate rise is accompanied by an increase in yield volatility, the constant-volatility management process we described will decrease exposure to government bonds accordingly.
- **Explicit drawdown control** — Limits on individual position size will control bond exposure during a period of negative correlation, thereby controlling the return impact if rates rise. A drawdown (or stop-loss) filter will reduce the portfolio volatility target and related position sizes if a rate rise should translate into meaningfully negative portfolio performance.
- **Opportunistic hedging** — Prudent purchases of interest-rate hedges (direct hedges such as payer swaptions or cross hedges such as yen puts) can reduce the impact of a rate rise.
- **Active management** — Portfolio performance should be improved by reducing the risk contribution target for government bonds when factors such as valuation and technicals flag concerns about the return prospects for the asset class.
- **Alternative betas** — These betas have the potential to generate positive returns in a rising-rate environment (e.g., a US government bond momentum strategy could have a short position).

We think these important safeguards can help maintain both the performance appeal and philosophical integrity of a risk-parity portfolio even during a period of rising interest rates.

Given continued global economic uncertainty, we believe that this kind of risk-parity strategy — one with the flexibility to address evolving risks and opportunities and to mitigate the impact of bouts of risk aversion — fits the realities of today's world.

About the Author

Steve is the director of the Tactical Team within the Asset Allocation Strategies Group and a portfolio manager focusing on our Global Managed Risk and Multi-Asset Absolute Return portfolios. He is also involved in the management of our Real Total Return and target-date portfolios.

APPENDIX: A Closer Look at the Alternative-Beta Opportunity Set

A number of factors will determine how much of the alternative-beta opportunity set shown in **Figure A1** makes it into the final alternative-beta portfolio. Strategies differ in cash efficiency — that is, some use derivatives while others require transactions in physical securities. They also entail varying levels of counterparty risk, leverage, shorting, liquidity, and correlation with traditional asset classes. Some simply generate more compelling risk-adjusted-return attributes than others. Finally, some strategies may be redundant if investors gain exposures to these factors through distinct allocations to credit, hedge funds, privates, and other asset classes. Determining both the overall objective and the tolerances for each of these considerations is a key step in structuring an alternative-beta portfolio.

Another critical step is thoroughly understanding the return characteristics of each alternative beta. For example, let's consider a reasonably straightforward alternative beta: size. **Figure A2** summarizes the US small-cap premium over the past 80 years. We define this premium as the beta-adjusted excess return of US small-cap stocks over US large-cap stocks. This approach eliminates any volatility-related return differences and is consistent with how one would implement such a strategy. (We use a 24-month rolling beta to maximize the historical data set. This introduces a little noise relative to longer rolling windows but does not materially change the results.) Over the entire period, the premium is significantly positive (3%) despite the equity-like volatility. Further, much of the premium can be traced to very strong performance during the early part of economic expansions. The remainder is associated with the latter part of recessions (although not a statistically significant observation). In other words, as **Figure A2** shows, the small-cap premium is earned in chunks and it can be negative for extended periods of time. The positive skewness is attractive — an elusive "long volatility" attribute indicating upside optionality. The near-zero correlation with large-cap stocks is also appealing.

The regime specificity of the small-cap premium argues for an opportunistic role, and transaction costs dictate that this not be subject to frequent adjustments. A willingness to miss out on some positive return during periods in which the odds are

Figure A1

Alternative-Beta Opportunity Set

Group	Carry	Momentum	Mean Reversion	Quality	Liquidity
Trade Type	**Status Quo, Short Volatility**	**Persistence, Sentiment, Divergence**	**Convergence, Contrarian**	**Leverage Aversion, Sharpe Ratio**	**Patience, Staying Power**
Examples	Selling Implied Volatility	Trend Following	Relative Value	High-Quality Over Low-Quality Stocks	Off-the-Run Over On-the-Run Treasuries
	Bond Carry		Volatility Arbitrage	Low-Beta Over High-Beta Stocks	Size (Small Capitalization)
	Commodity Carry		Statistical Arbitrage	Low-Volatility Over High-Volatility Stocks	Corporate Bonds
	Currency Carry		Convertible Arbitrage	High-Credit-Rating Over Low-Credit-Rating Bonds	Private Equity (Buyout, Venture, Distressed, Mezzanine)
	Credit Spreads		Merger Arbitrage	Short-Maturity Over Long-Maturity Bonds	Direct Real Estate (Commercial Real Estate, Timberland)
			Yield-Curve Arbitrage		Private Placements (PIPEs, 144-A)
			Basis Trading		Art and Collectibles
			Reversal		

Source: Wellington Management

working against you (e.g., late expansions) should be part of the alternative-beta mindset. Other strategies can carry the return-generating burden during such times. Finally, the associated volatility, liquidity, and cash required to fund the position argue for a modest position size.

We believe that emphasizing the carry and momentum groups creates a strong foundation for the alternative-beta portfolio. The carry constituents can range from currency carry, in both developed and emerging markets, to spreads, including investment-grade bonds, high-yield bonds, and mortgage-backed securities. Importantly, these should not be passive investments. They should be combined with risk filters that eliminate holdings when the probability of a negative tail event exceeds a certain threshold. The momentum constituents can include trend-following models spanning multiple asset classes: equity, fixed income, currency, and commodities. As with the carry models, incorporating some risk filters can help the momentum betas navigate challenging environments.

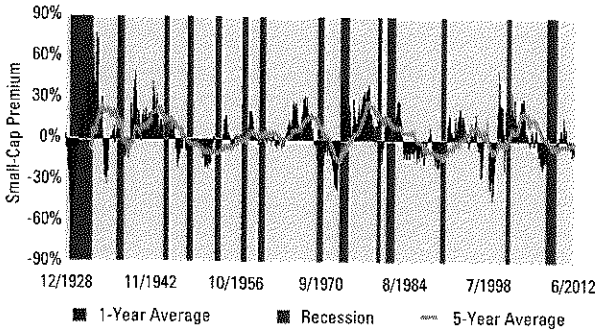
This blend of carry and momentum strategies requires little cash, is very liquid, and introduces almost no correlation with traditional asset classes. (We acknowledge that correlations do ebb and flow. Correct momentum positions in a rising market will introduce positive correlation, but correct momentum positions in a falling market will introduce negative correlation.) Further, this blend can mitigate drawdowns by the core asset classes and could provide a particularly valuable boost in a low-return environment for the core asset classes.

Lastly, it is important to be clear about the objective of alternative betas, which is not to create a suite of discount alpha strategies. The objective is to determine if any useful factors are at work in a cross-section of active strategies and to create a set of systematic trading rules that will generate positive returns over time — returns that also diversify core asset class returns. The belief is that the risk premia or behavioral biases historically driving these returns will persist, not that these alternative betas represent a substitute for a well-managed active strategy, as these betas are more akin to a style benchmark.

Figure A2

US Small-Cap Premium

January 1928 – July 2012



	Late Expansion	Early Recession	Late Recession	Early Expansion	Entire Period
Average Return	0.5%	-6.0%	5.6%	7.4%	3.1%
t-Statistic	0.2	-1.1	0.7	2.8	1.8
Standard Deviation	15.0%	15.6%	21.5%	15.5%	16.0%
Return/ Volatility	0.0	-0.4	0.3	0.5	0.2
Occurrence	40%	10%	10%	40%	100%
Correlation w/Large Cap	0.0	0.1	0.0	0.1	0.0
Skewness	0.7	0.9	1.5	3.1	1.8

Given the volatility in the early part of this data sample, it is worth noting that the summary table is quite similar if we begin the analysis in 1960.

NBER recessions

Sources: Standard & Poor's, Ibbotson, Wellington Management

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ABOUT WELLINGTON MANAGEMENT Tracing our roots to 1928, Wellington Management is one of the largest independent investment management firms in the world. We are a private firm whose sole business is investment management, and we serve as investment adviser for institutional clients in over 50 countries. Our most distinctive strength is our commitment to proprietary, independent research — the foundation upon which our investment approaches are built. Our commitment to investment excellence is evidenced by our significant presence and long-term track records in nearly all sectors of the liquid, global securities markets.

Invesco

Invesco Balanced-Risk Allocation Fund

A Risk-Balanced Approach to Asset Allocation

Executive Summary

The protracted downturn in both the credit and equity markets has compromised many asset allocation strategies that did not adequately account for total portfolio risk. Yet, this is hardly the first instance of underperformance from traditional mean-variance-based asset allocation. Significant declines have occurred repeatedly during bear markets and corrections, undermining the intended goal of asset allocation: to mitigate risk and grow portfolios consistently over time. We believe the traditional "balanced" portfolio – 60% equities and 40% fixed income – does not adequately address overall portfolio risk. Such a structure may derive as much as 90% of its risk from the equity allocation because stocks are generally so much riskier than bonds.

With Invesco Balanced-Risk Allocation Fund, we're delivering on the next phase of innovative asset allocation solutions. Our risk-balanced portfolio construction technique seeks to weight the assets – stocks, bonds and commodities – so that they each contribute a relatively equal amount of risk to the portfolio. The approach seeks to limit the effect of underperformance from any single asset on overall fund performance.

One of the primary objectives of our risk-balanced investment strategy is to build a portfolio that can perform well in different economic environments. We seek to capture most of the performance of a 60/40 portfolio in a noninflationary growth environment, when equities have typically performed well. But we believe the true benefit of the risk-balanced approach comes in recessionary environments, where the strategy is designed to protect on the downside and preserve portfolio value. The strategy also seeks to outperform a traditional 60/40 portfolio in inflationary growth environments due to the fund's commodity exposure. The result is a strategy designed to provide downside protection while seeking to provide the opportunity for higher compounded returns over time.

Highlights

- Uses a long-only, proprietary risk-balanced investment process
- Targets equity-like returns with bond-like risk
- Seeks attractive returns in a variety of economic environments
- Employs a beta-capture technique with an active positioning component

Investment process

We believe the best strategic allocations are those that defend the portfolio in various economic environments while still participating in economic growth. To do this, investors must not only be mindful of their asset selection, but must also reconsider how they mix these assets when constructing their portfolios. To achieve this objective, we follow a well-defined, three-step investment process:

- Asset selection
- Portfolio construction
- Active positioning

Asset selection

Our goal is to build an allocation that can both defend the portfolio and participate in economic growth during all three major types of economic environments: recessionary, noninflationary growth and inflationary growth.

Most investors have portfolios that are biased toward assets that have historically performed well in periods of noninflationary growth, such as stocks. Allocations to bonds, which have generally provided a strong defense against recessionary periods, are often too short in duration and too oriented toward credit risk. Historically, the best assets for a recession have been long-duration, hedged government bonds (see table below). With this in mind, the fund's bond allocation is directed solely to government bonds.

Additionally, investors are often underexposed to assets that have historically performed well in inflation-driven markets – such as commodities, which may be one of the most liquid ways to obtain inflation protection. Because of the unique diversification benefits within commodities, balancing risk across the major commodity categories – energy, precious metals, industrial metals and agriculture – may help improve performance relative to a common commodity-oriented benchmark such as the S&P GSCI™, which is dominated by exposure to energy.

Historical Asset Class Response to Economic Environments

	Inflationary Growth	Noninflationary Growth	Recessionary/ Deflationary
Equities	↔	↑	↓
Fixed Income (Government Bonds)	↓	↔	↑
Commodities	↑	↔	↓

Source: Invesco. Time period represented September 1976 through June 2010. For illustrative purposes only. Past performance cannot guarantee future results.

We consider three criteria when selecting assets:

- **Diversification/low correlation among assets.** We estimate long-term correlations among assets to build a fund that is diversified across asset classes. Redundant asset classes are eliminated.
- **Theoretical basis for excess return.** We analyze each asset's expected excess returns over cash – its risk premium. These criteria are straightforward for stocks and bonds, but require additional analysis for commodities. We believe commodities should provide excess returns. Certain commodities have unique properties, such as the expense and difficulty of storage, that can lead to normal backwardation[1] in the market and increase the fund's opportunity to capture the roll yield and improve results.
- **Liquidity, transparency and flexibility.** We invest in exchange-traded futures and commodity-linked notes on the most liquid equity, sovereign debt and commodity markets. This strategy provides pure asset class exposure, provides ample capacity, allows for daily liquidity and shields the fund to a large extent from counterparty risk.

1 Backwardation is a situation where the amount of money required for future delivery of an item is lower than the amount required for immediate delivery of that item.

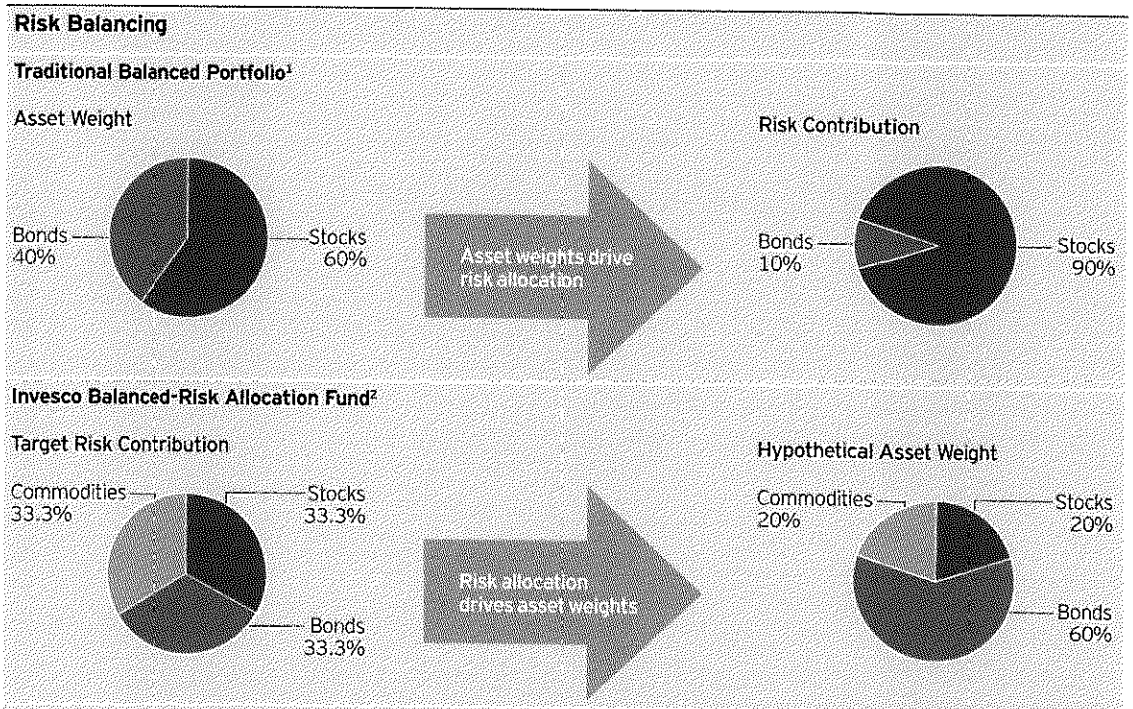
Portfolio construction
The fund's portfolio construction is best described in comparison to more traditional portfolios.

In the chart below, the top-left pie chart illustrates the asset weightings of a 60% stock/40% bond portfolio. While investors often characterize this as balanced, it is quite imbalanced in terms of risk. The pie chart on the top right shows that approximately 90% of the portfolio's risk comes from stocks – the more volatile asset class. This means that 60/40 portfolios often perform poorly in periods that don't favor stocks – recessionary and inflationary growth.

An alternative approach is to build a portfolio that seeks a relatively equal amount of risk from assets representing each of the three major economic environments – as illustrated in the bottom-left pie chart. This desired risk allocation drives the weight of each asset class.

We believe this approach to portfolio construction may help mitigate large losses in capital and improve the portfolio's reward relative to the risk taken (i.e., Sharpe ratio). We believe the risk-balanced portfolio is better hedged against negative economic outcomes such as high inflation and deflation because of the exposure to commodities and bonds, respectively.

Risk Balancing



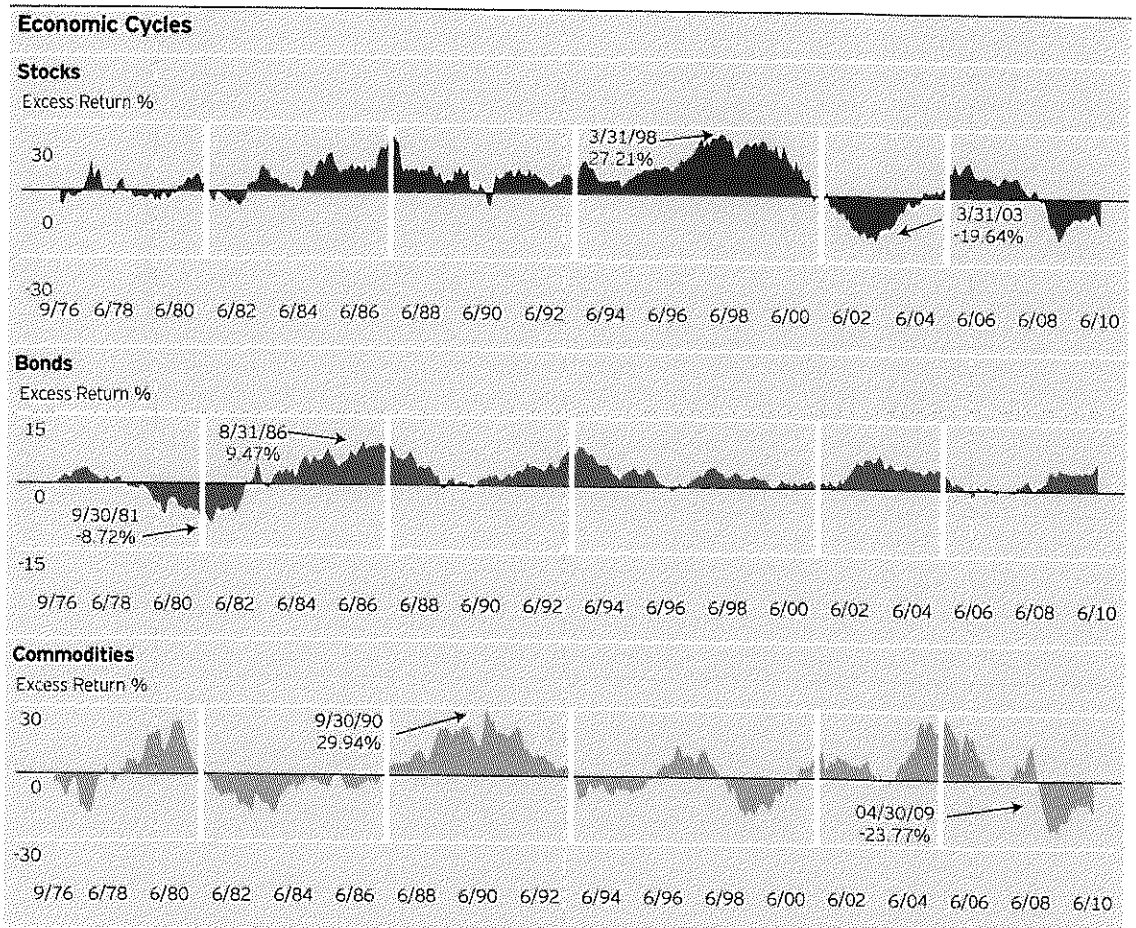
1 Source: DataStream. Time period represented: Aug. 31, 1973, to June 30, 2010.
2 Source: Invesco. Target risk contribution represents the risk contribution sought by the portfolio managers and is not intended to represent actual portfolio weights at any given time. Hypothetical asset weight is for illustrative purposes only, and is not intended to represent actual portfolio weights at any given time.
Commodities are represented by the S&P Goldman Sachs Commodity Index, which is an unmanaged composite index of commodity sector returns representing an unleveraged, long-only investment in commodity futures that is broadly diversified across the spectrum of commodities. Bonds are represented by the Barclays Capital U.S. Treasury Index, which is an unmanaged index of public obligations of the U.S. Treasury with a remaining maturity of one year or more. Stocks are represented by the S&P 500® Index, which is an unmanaged index considered representative of the U.S. stock market. An investment cannot be made directly in an index. Past performance is not a guarantee of future results.

Active positioning

When setting our risk allocation, we work within a specified risk range, which gives us some room for active positioning within the three asset classes. This is important because each of the asset classes has a different exposure to the economic cycle. For example, bonds historically perform poorly when inflation and real growth rise; commodities historically perform well under these same circumstances.

The economic environments that we have discussed – recessionary, inflationary growth and noninflationary growth – tend to be persistent. In other words, they tend to last longer than a quarter or two, which creates the opportunity to actively allocate among the assets.

The chart below demonstrates this by looking at the rolling three-year excess returns of each asset class. The vertical lines represent major shifts in the economic environment. For example, the first vertical line on the left represents the point in 1981 when the Fed raised interest rates to combat inflation and, in the process, sent the global economy into recession. Commodities should perform quite poorly in such an environment – the bottom chart shows they did. Bonds, on the other hand, should and did perform well. This situation lasted about six years.



Sources: DataStream, Invesco. Time period represented September 1976 through June 2010. Rolling three-year excess return to cash. Commodities are represented by the S&P Goldman Sachs Commodity Index, which is an unmanaged composite index of commodity sector returns representing an unleveraged, long-only investment in commodity futures that is broadly diversified across the spectrum of commodities. The returns are calculated on a fully collateralized basis with full reinvestment. The combination of these attributes provides investors with a representative and realistic picture of realizable returns attainable in the commodities markets. Bonds are represented by the Barclays Capital U.S. Treasury Index, which is an unmanaged index of public obligations of the U.S. Treasury with a remaining maturity of one year or more. Stocks are represented by the S&P 500® Index, which is an unmanaged index considered representative of the U.S. stock market. An investment cannot be made directly in an index. Past performance is not a guarantee of future results.

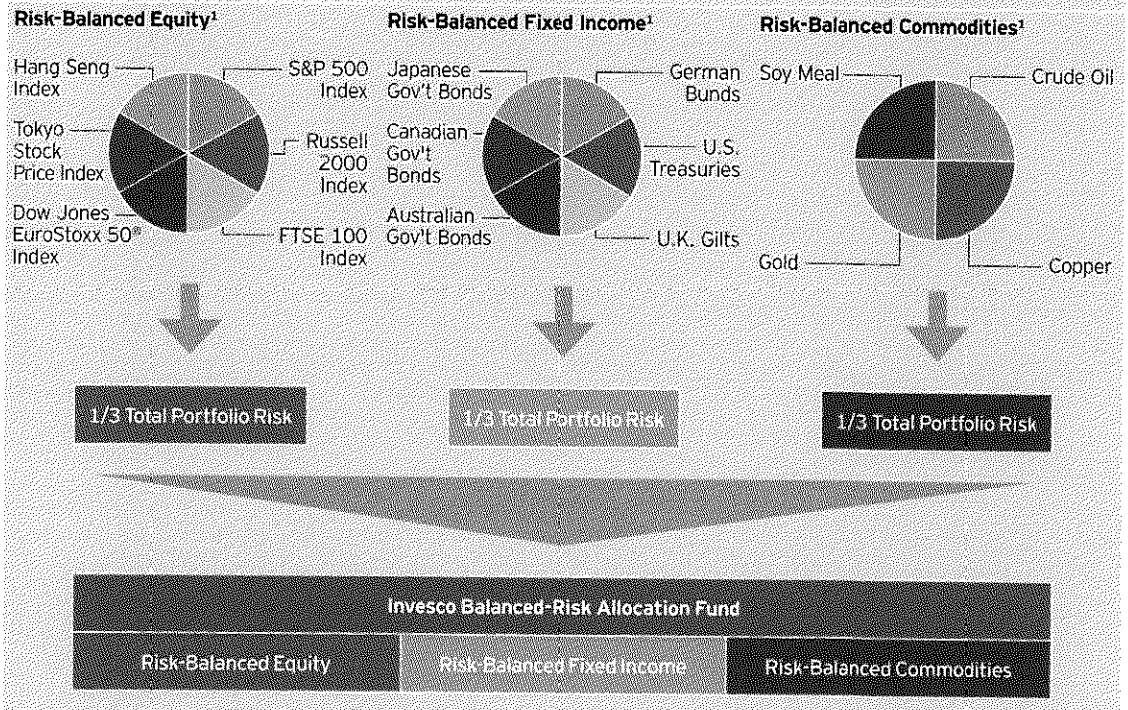
Fund composition

These three steps – asset allocation, portfolio construction and active positioning – result in the Invesco Balanced-Risk Allocation Fund. An illustration of the fund's risk-balanced composition is shown in detail in the chart below. The three pie charts depict each asset class. Equities and fixed income are divided into geographic regions to take advantage of the differences in regional economic cycles. We divide commodities into energy (crude oil), industrial metals (copper), precious metals (gold) and agriculture (soy meal).

For equities and fixed income, the assets chosen represent the most liquid assets in each region. The same is true for most commodities, with agriculture as the exception. There, we selected the commodity we believe is most likely to result in long-term excess returns – soy meal – rather than the more liquid alternatives.

It is important to note that for the strategic asset allocation, which is reset annually, we seek to weight each asset class so that it represents one-third of the total fund risk, and we aim for each asset within each asset class to represent an equal risk weight. For example, the S&P 500® Index should contribute the same risk to the total fund as the Hang Seng Index.

Invesco Balanced-Risk Allocation Fund
Strategic asset allocation

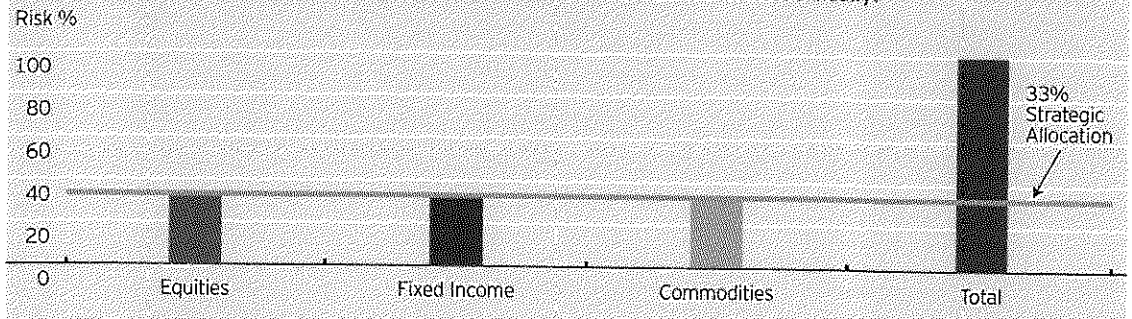


Source: Invesco
1 Can be implemented with physical securities, derivatives or financially linked instruments. For illustrative purposes only. An investment cannot be made in an index.

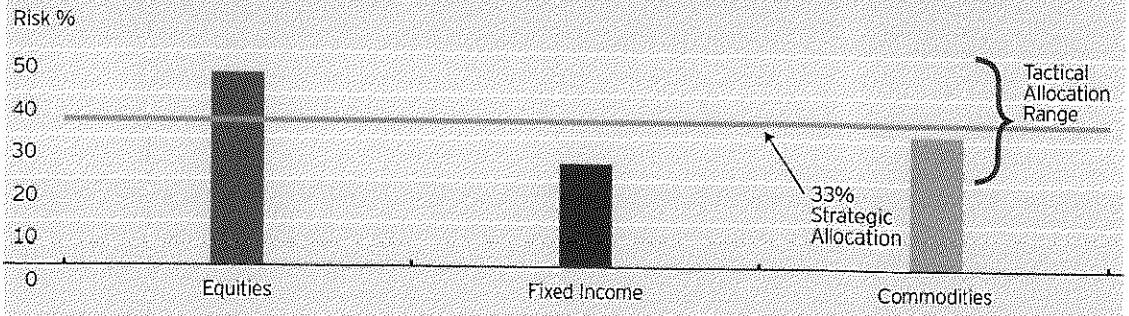
After we determine the risk-balanced composition, we apply our active positioning process. Active positioning is applied at the individual asset level, but when aggregated into an asset class, such as equities, it shifts the asset class risk weights between about 20% and 50% (see chart below). We will never completely remove an asset class from the fund.

Active Positioning: Strategic Versus Tactical Asset Allocation

Equilibrium Contribution to Portfolio Risk – Strategic Allocation[1]
Strategic allocation is calculated through volatility and correlation estimates and is reset annually.



Contribution to Portfolio Risk – Tactical Allocation Range[1]
Active positioning allows the asset weights to deviate from the long-term strategic allocation. Tactical allocations are adjusted monthly. Depending on the tactical indicators, the fund can be positioned within the predetermined risk ranges.



Source: Invesco
1 Can be implemented with physical securities, derivatives or financially linked instruments
The figures above do not represent specific time periods or actual fund results. The risk from each asset class will be within the target risk guideline range 95% of the time based on the current market volatility level. Asset classes are subject to change and are not buy/sell recommendations. For illustrative purposes only.

Role of leverage
As stated earlier, we believe a truly balanced portfolio should equalize the risk borne by each asset. Therefore, it is necessary to use leverage, mainly applied within the fixed-income allocation, to achieve the desired long-term risk balance among all the asset classes, as well as to achieve the desired overall risk target.

The total maximum market exposure cannot exceed 250% of the underlying asset base of the fund.

Please note that the use of derivatives involves risks. See the last page for details.

Conclusion

The current financial market crisis has accelerated a much needed overhaul in thinking about asset allocation. Market downturns repeatedly affect aggregate portfolio performance in a way that indicates risk is not being sufficiently addressed. Our experience in risk management has taught us that the most efficient portfolios seek to balance the amount of risk contributed by each of their parts.

Investors seeking to fine-tune their portfolios must reconsider their asset mix and the role of risk in reinforcing a sound portfolio. By applying a risk-balancing approach, investors can create a portfolio that may be a cut above traditional asset allocations. The Invesco Balanced-Risk Allocation Fund may be a favorable alternative to the traditional balanced portfolio for the following reasons:

- **Innovative approach.** Uses a risk-balanced approach that seeks to weight each asset so that it contributes a relatively equal amount of risk to the portfolio. We believe this approach may diversify risk much more effectively than a traditional 60/40 stock-bond allocation.
- **Economic positioning.** Seeks attractive returns in a variety of economic environments.
  - Noninflationary environment. Seeks to capture most of the performance of a traditional 60/40 portfolio in a noninflationary growth environment, when equities have typically performed well.
  - Recessionary environment. May demonstrate true potential during recessionary environments by seeking to protect on the downside and preserve portfolio value.
  - Inflationary environment. Strives to outperform a traditional 60/40 portfolio in inflationary growth environments due to its commodity component.
- **Active positioning.** Takes advantage of near-term market opportunities while remaining consistent with the optimized portfolio structure.
- **Flexible application.** Offers flexible portfolio application as a core or satellite holding based on client needs.
- **Management expertise.** Reflects Invesco's extensive expertise in global tactical asset allocation (GTAA) strategies and is actively managed by five seasoned portfolio managers, each with more than 13 years of investment experience.[1]

The fund is flexible by design and may fill a variety of roles for the following target markets:

- **Risk-averse investors desiring equity-like returns with bond-like risk.**
  - Investors, at any life stage, needing to improve their risk-and-return profile.
  - Pre-retirees looking for capital preservation with potential for growth prior to retirement.
  - Current retirees seeking investment options that may help preserve capital and maintain appropriate portfolio diversification. Diversification does not guarantee a profit or eliminate the risk of loss.
- **Investors looking to fine-tune their asset allocation strategy.**
- **Defined contribution (DC) plans for plan sponsors:**
  - Identifying a significant percentage of their workforce as risk averse.
  - Wishing to offer an alternative or complement to existing asset allocation investment options.
  - Considering a default investment for their employees.
  - Seeking a foundational building block for custom-designed target date and risk-based portfolios.
- **Asset allocation providers.** Firms that market model portfolios or fund-of-fund products.

As investors increasingly focus on balancing preservation and growth of capital, we believe a risk-balanced approach to asset allocation is essential for long-term durability.

1 As of June 30, 2010

About risk

The fund may use derivatives as a substitute for purchasing the underlying asset or as a hedge in an effort to reduce exposure to risks. Use of derivatives involves risks similar to, as well as risks different from, and possibly greater than, the risks associated with investing directly in securities or more traditional instruments. Derivatives may also be more difficult to purchase, sell or value than other investments and are subject to counterparty risk – the risk that the other party will not complete the transaction with the fund. A fund investing in a derivative could lose more than the cash amount invested.

The fund may use enhanced investment techniques such as leverage. Leveraging entails risks such as magnifying changes in the value (both positive and negative) of the portfolio's securities.

Interest rate risk refers to the risk that bond prices generally fall as interest rate rise and vice versa.

Credit risk is the risk of loss on an investment due to the deterioration of an issuer's financial health. Such deterioration may lead to the issuer's inability to honor its contractual obligation, including timely payments of interest and principal.

Foreign and developing markets securities have additional risks, including exchange rate changes, political and economic upheaval, relative lack of information, relatively low market liquidity, and the potential lack of strict financial and accounting controls and standards.

The fund or the subsidiary may invest in commodity-linked derivative instruments that may be subject to greater volatility than investments in traditional securities.

The fund is indirectly exposed to the risks associated with the subsidiary's investments. The subsidiary is not registered under the 1940 Act and may not be subject to all the investor protections under the Act. Accordingly, the fund will not have all the protections offered to investors in registered investment companies.

The fund is subject to currency/exchange rate risk because it may buy or sell currencies other than the U.S. dollar.

Because it is nondiversified, the fund may invest in securities of fewer issuers than if it were diversified. Thus, the value of the fund's shares may be subject to greater volatility and market and credit risk. Because a large percentage of the fund's assets may be invested in a limited number of holdings, a change in value of these holdings could significantly affect the value of an investment in the fund.