Constraints and Innovations for Pension Investment: The Cases of Risk Parity and Risk Premia Investing

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Although their annual spending budgets may vary, institutions in the United States have investment return assumptions that are typically within the range of 7% to 8% per year in their spending and investment policies.

On the conundrum of negative real yields, Perold [2012a] points out that one can achieve a positive real return only by taking risk and also discusses the tradeoffs among capital preservation, diversification, active management and risk stabilization in making investment decisions concerning taking risk and maximizing return. Research suggests that attitudes towards risk can be driven by an investor’s background and recent market returns, among other factors. A few years out of the global financial crisis, we have observed that institutional investors are increasingly focused on capital preservation and are more averse to drawdowns when making investment decisions. We believe active management is a zero-sum game at best, as the average active manager underperforms, net of fees and other costs. In a “risk on, risk off” environment, as described in Lee [2012], risk-adjusted value added from active management is expected to decline in a normative sense when the breadth of active investment decisions is squeezed into a more diminished opportunity set.

Nevertheless, such challenges and headwinds to active management do not necessarily preclude the possibility of narrowing the return shortfall, as long as one can successfully identify and allocate to active managers who in fact outperform, which is in itself a challenging task at which few have shown consistent success. Although risk stabilization, as described in Perold [2012b], may potentially improve portfolio efficiency, it requires relatively accurate forecasts of risks for the purpose of stabilization, as well as dynamic trading of derivatives and a governance structure that institutional investors often find difficult to adopt. That leaves diversification as the remaining viable alternative.

Perold [2012a] portrays the role of diversification not as a preventative measure against a decline in portfolio value, but rather a protection against overinvesting in the worst-performing asset class and suffering a loss from which recovery may be difficult or even impossible. Given the uncertainty of the future and errors in forecasts, few would argue that diversification is unnecessary. Some go even further, labeling diversification as the only free lunch in investing. But how much diversification is appropriate, and what are the units of measurement in determining the appropriate amount in the first place? In recent years in particular, some ad hoc metrics of diversification have been proposed, but none comes with a well-defined or meaningful investment objective. To the contrary, Markowitz’s [1952] mean–variance
paradigm provides an analytical recipe for determining how much diversification is optimal, given a set of investment views that includes expected returns and risks of assets. The mean–variance optimal portfolio is the portfolio constructed to achieve the highest expected Sharpe ratio, given those investment views, and therefore is theoretically the best-diversified portfolio subject to the forecasts of returns and risks.

Forecasting, however, has never been easy. For instance, Hammond and Leibowitz [2011] survey almost 20 different estimates of the long-term equity risk premium published mostly between the years 2000 and 2003 and find that the estimates ranged from 0% to 7%. Given this range, and depending on which forecasts were used, one would expect the resulting strategic portfolios to have dramatically different allocations to stocks, but ex post this was not the case. In fact, although institutional investors might have worked with different investment managers and consultants with different approaches that led to different long-term forecasts of asset returns and risks, their relative strategic allocations to stocks and bonds have not been far from the often-cited 60/40 stock and bond portfolio. It is generally acknowledged that, with an investment objective of maximizing portfolio efficiency and given reasonable risk estimates, a 60/40 portfolio of stocks and government bonds reflects an extremely bullish view on stocks, suggesting that the expected Sharpe ratio of stocks should be about three to five times that of bonds for such a portfolio to be deemed mean–variance optimal. As such, in the 60/40 portfolio, stocks often account for between 80% and 90% of the total portfolio risk, reflecting relative bullishness on stocks versus bonds. Why have institutional strategic portfolios been relatively similar in both capital and risk allocations between stocks and bonds, even when investment views might have been quite different among investors? The answer most likely lies in these investors’ required returns in the presence of constraints.

Typical institutional investors in the United States and elsewhere are known to be averse to—or in many cases strictly restricted from—using leverage or taking short positions. Aversion to or restrictions on leverage, together with the return requirement, could essentially force an institution to take concentrated risks on stocks, the asset class that has among the highest historical risk premia among publicly traded assets, regardless of whether the institution is indeed so bullish on stocks, relative to bonds. The disappointing investment performance of many institutional portfolios around the global financial crisis, particularly in 2008, might not have been the failure of diversification, as often cited by pundits and critics of modern portfolio theory, but rather was likely the consequence of an intentional concentration of risk in stocks as an attempt—recognized ex ante and ex post as a very risky one—to achieve the required returns, given the constraints.

That is history. What about the future? If stocks’ expected Sharpe ratio has not become much higher than that of bonds, compared to historical results, and the restrictions on leverage and shorting are here to stay amid similar required returns, then the risk concentration in stocks is also likely to remain in many institutional portfolios. Anecdotal evidence suggests that some institutions have been de-risking their portfolios, with many more citing this as an area of focus going forward. De-risking, however, may have the undesirable outcome of lowering the expected return, unless the portfolio’s overall efficiency can be lifted by other means.

Recognizing these challenges, some product manufacturers have promoted strategies in recent years that are labeled as more diversified answers to the conundrum. Two of these are risk parity and risk premia investment approaches, both of which have been claimed by their proponents as being capable of achieving better diversification.

**RISK PARITY INVESTING**

In simple terms, a risk parity portfolio allocates capital so that each asset is expected to contribute equal risk to the overall portfolio, where risk is typically defined as volatility. Even if equal risk contribution is in itself not that meaningful an investment objective, mean–variance optimality conditions of the risk parity portfolio have been derived and discussed. For instance, it can be shown that, in the special case when Sharpe ratios and correlations among all assets are expected to be the same, the risk parity portfolio is a mean–variance optimal portfolio. Although an investor may not totally agree with these embedded investment views, we believe the more important and relevant analysis is to assess the spectrum of investment views: the equal Sharpe ratios view of a risk parity portfolio on one hand and, as discussed, the extreme bullishness of stocks in a 60/40 portfolio on the other.
For investors who believe that assets’ Sharpe ratios are comparable, if not identical, then clearly the risk parity portfolio is closer to being optimal than is the 60/40 portfolio. It has been widely documented that, although assets’ Sharpe ratios may be very different over shorter time horizons, over the long term they have been more comparable. As a result, history appears to support the notion that the risk parity portfolio is indeed a more efficient portfolio for the long term than the 60/40 portfolio, which is far more bullish on stocks. Because stocks are riskier than government bonds, it is not unusual to see a risk parity portfolio have a substantially higher capital allocation to bonds, in order to balance stocks’ higher risk. Although the risk parity portfolio may truly be more efficient than the 60/40 portfolio in risk-adjusted terms, its risk may prove to be too low, given its higher allocation to less risky assets; therefore, its potential return can still fall short of required returns. Here is where leverage comes into the discussion.

To preserve the relative capital and risk allocations and thereby maintain the efficiency of the risk parity portfolio as much as possible, leverage is an option, using derivatives such as futures contracts. For instance, a risk parity portfolio of 20% equity and 80% bonds (20/80) can be leveraged to 50/200 in stocks and bonds, reflecting gross leverage of 2.5 times, so that both the return and the risk of the unlevered portfolio are expected to grow with leverage. On paper, an institutional investor can use an appropriate degree of leverage to push the expected return and risk in line with targets. In reality, however, the management of a risk parity portfolio is often outsourced to an external manager, for reasons that include restrictions on using leverage, less experience in risk modeling, and insufficient infrastructure support and governance structure.

“Leverage” can mean different things in economic terms. Whether a certain position counts as leverage or not often depends on the circumstances. A household mortgage is leverage, as the homeowner borrows to consume today and improve present utility through homeownership. A student loan is leverage, as the student borrows in order to finance today’s investment, in the form of tuition, with the goal of improving future utility through education. Owning the piece of paper called a stock certificate is not leverage, however, even though the underlying investment—the company—has corporate debt. Nor is investing in hedge funds or private equity considered leverage on a balance sheet, even though some of these investment vehicles are often quite leveraged. When institutions buy futures contracts with total notional value exceeding capital, this is leverage, irrespective of the underlying purpose and even if it is fully collateralized. For instance, negative correlation over approximately the last five years between the two core asset classes—stocks and government bonds—has tended to dampen total portfolio volatility as a result of over-diversification, everything else being equal. If these two asset classes’ future Sharpe ratios are not higher than their historical values when their correlation was positive, then the future expected return of a portfolio made up of these two assets is likely to be lower, providing another headwind to institutions’ return objectives. One can seek to mitigate this headwind by using futures contracts to leverage up the portfolio’s total notional value beyond 100%, similar to what a leveraged risk parity portfolio would do.

Forecasting is difficult, but it is generally agreed both in theory and in practice that the errors in forecasting risks are less significant than the errors in forecasting returns. Many assets’ associated risks have exhibited similar time-series properties, including short-term persistence and long-term mean reversion. The weather is a good analogy. Current weather conditions are a good basis for forecasting weather in the next hour, as weather tends to persist in the short term. To forecast weather one month from now, however, one may want to check the average temperature, rainfall, and other historical trends of recent years or even decades, as weather is governed by the local conditions and seasons—and weather tends to mean revert towards the average over the longer term.

Lastly, because assets’ risks and correlations change over time, dynamic trading is necessary to maintain the risk parity portfolio’s predetermined risk profile. Dedicated operational support, including trading, middle- and back-office functions, counterparty risk management, and marked-to-market profit and loss performance measurement are all required.

In summary, an external risk parity manager’s utility can extend well beyond asset management, potentially moving towards portfolio efficiency with more flexibility around efficient risk allocation. A risk parity manager is a service provider for a range of functions that an institutional investor may have limitations or restrictions on performing itself.
RISK PREMIA INVESTING

In recent years, some articles have suggested that asset allocation based on how assets are exposed to underlying risk factors—dubbed the risk factor, factor-based, or risk premia approach—is superior to the traditional approach with asset classes. Following the mainstream asset-pricing theories, Kaya, Lee, and Wan [2012] explore using state variables, such as growth and inflation, as risk factors. Their empirical results show that such economic risk factors fail miserably in capturing assets’ risks and correlations. They also argue that, although the risk factor approach may bring more intuition to the investment and risk management process, it is merely a structural approach to modeling the covariance matrix of assets that specifies how assets are correlated with others through their different exposures to a set of common factors. Although such a structure may shed light on assets’ risk characteristics, it also introduces a new set of challenges around parameter uncertainty. The risk-factor approach to risk modeling, as argued, can at best match (but not exceed) the performance of the asset-class approach. In practice, some product manufacturers may pursue a relatively descriptive approach, such as grouping assets classes according to their estimated or perceived sensitivities to growth and/or inflationary conditions. Ang [2012] documents that TIPS and selected commodities (such as gold, for example) have very low correlations to inflation, while Ang, Briere, and Signori [2012] report that individual stocks’ historical sensitivities with respect to inflation, known as inflation betas, are unreliable in constructing an inflation-hedging stock portfolio. Interestingly, both studies conclude that cash is among the best inflation hedges, though cash does not provide the reward that many investors also seek, despite their stated objective of inflation hedging.

Recognizing that using asset portfolios to explain assets of interest provides far more statistically significant results, the majority of risk-factor approach proponents construct risk factors as long/short asset portfolios. Following the same direction, Kowara and Idozek [2013] show that the superiority of the factor-based approach over the asset-class approach, as claimed by some of its proponents, is not supported from a risk-management standpoint. True risk factors can at best be approximated by asset combinations, while the totalities of risks from assets are the true risks that the investors are bearing. Neither approach is inherently superior.

The true underlying objective behind some practical applications of the risk-factor approach may actually lie somewhere between hedging certain types of risks, such as inflation, and finding assets that are expected to reward investors when certain environments prevail. As a result, the verdict is still out on the relative effectiveness of the risk-factor approach versus the asset-class approach. Focusing more exclusively on investment performance enhancement, rather than purely on risk management, Bender, Briand, Nielsen, and Stefek [2010] and Ilmanen and Kizer [2012], among others, show that some alternative risk premia—ones that are (again) constructed as long/short asset portfolios—can provide performance enhancement to a portfolio through better diversification and improved returns than the traditional approach of using long-only asset classes, such as stocks and bonds. Is the risk premia investing approach another new answer to the conundrum?

First and foremost is the need to understand the difference between risk factors and risk premia. Chan, Karceski, and Lakonishok [1998] provide comprehensive coverage of the topic, as well as diagnostics to examine the empirical validity of a chosen risk factor. Idiosyncratic risks that are unique to an asset can determine the asset’s volatility, but not its correlation to other assets. Therefore, for a variable to be a risk factor, it must drive correlations among different assets, through their systematic exposures to a factor. A risk premium, on the other hand, is a risk factor that rewards investors with positive, long-term returns for bearing such risk. Therefore, all risk premia must be risk factors, but not all risk factors are risk premia. To further complicate matters, even though a risk factor does not deliver a long-term premium, one may still be able to harvest alpha by successfully tilting toward (long) or away from (short) the factor, as long as its returns vary over time and are predictable.

Simple examples of risk premia may include the traditional asset classes of equity risk and duration risk premiums, defined as stock returns and longer-term government bond returns in excess of the short-term risk-free rate. In some of the articles already mentioned, the alternative risk premia are typically constructed as long/short asset portfolios. As examples, the widely cited value, carry, and momentum factors as alternative risk premia all require taking long positions on assets that are ranked highly with respect to the premium (e.g., value), and hedged by taking short positions on assets that are...
ranked near the bottom according to these premia’s different criteria.

Suppose an investor can invest in any investable asset class, security, or access vehicle, including individual stocks, bonds, commodities, futures contracts, and forward contracts. Within this context of a broadly comprehensive universe of investment vehicles, the traditional asset class approach, such as investing in the stock market, is equivalent to a buy-and-hold style of investing in a basket of individual stocks that are weighted by their market values. The risk premia approach, however, can not only invest in the market capitalization-weighted, long-only stock asset class, but it is also free to use gross leverage and short selling to invest in dollar-neutral portfolios with long/short positions in stocks that are ranked high/low according to value and momentum criteria, among others. Technically speaking, investors achieve the risk premia approach by applying an unconstrained linear rotation to the grand universe of investable securities in such a way that gross leverage, short sales, and dynamic trading are all allowed. The traditional asset class approach, by contrast, is the heavily constrained, long-only, buy-and-hold, market-capitalization-weighted subset of the grand universe. All else being equal, constraints can hurt performance and therefore the risk premia approach is likely to be superior, with its apparent superiority largely the result of removing constraints from the traditional approach. Proponents of the risk premia approach normally emphasize increased diversification benefits by showing lower correlations of these premia with the traditional asset classes than correlations found among the asset classes themselves. Note that any randomly generated, dollar-neutral long/short stock portfolio should have most of its market exposures or market betas hedged away and therefore should have low correlations with asset classes by construction, regardless of whether these long/short portfolios are meaningful constructs.

Building on the apparent success and growing popularity of risk-based approaches applied to security selection, recent research argues that a risk parity portfolio of securities is not necessarily diversified, and the portfolio can still have relatively concentrated exposures to certain risk factors. Lohre, Neugebauer, and Zimmer [2012] go on to propose building risk parity portfolios, based on the underlying risk factors instead of on securities, an approach they term “diversified risk parity.” Although such an approach can be statistically interesting, one should not overlook the underlying economic meaning, or the risk of over-engineering may be introduced. It is also important to remember that the investment process should start with a clearly stated objective. In its absence, Lee [2011] proposes using mean–variance optimality as the common reference point, based on the observation that proponents of all risk-based portfolios, including risk parity, evaluate performance based on Sharpe ratios, without exception. Using this as a backdrop, proponents of diversified risk parity may need to provide a sound economic rationale for the idea of achieving portfolio efficiency through diversification among factors and, more importantly, define what the factors are and why equal factor risks are desirable. For example, some studies use principal component analysis (PCA) to extract the unobservable risk factors. The principal components are sets of uncorrelated asset portfolios, with both long and short positions that together can fully characterize the risk characteristics of any underlying assets. In the case of applying PCA to a universe of individual stocks, for instance, the first extracted principal component is often found to be a long-only portfolio that resembles a capitalization-weighted portfolio, indicating that market risk is among the most important. The other principal components, however, often include both long and short positions. In sum, for the purpose of risk analysis, PCA may be a powerful tool for showing the underlying composition of statistical risk factors. However, it does not provide guidance on whether any particular principal component portfolio should be associated with a long or short sign. This is because, according to PCA, any principal component portfolio, irrespective of its direction, should carry the same information in explaining risk characteristics. Although the principal components’ sign insensitivity may not be an issue for risk decomposition, constructing a diversified risk parity portfolio based on the statistically extracted components can be problematic, if indeed these components are treated as risk premia, as their returns depend on the signs of the asset weights in these components. Some analysis of the extracted components, such as those conducted in Lohre, Neugebauer, and Zimmer [2012], is important to ensure that these components have sound economic meaning as risk premia. After all, statistical significance is not a substitute for economic significance. The key considerations regarding risk premia investing should therefore lie on the economic efficacy of these premia and their implementations, including their construction.
as well as how much exposure to such premia is considered reasonable.

Risk premia’s sustainability is debatable. For example, the question of whether demographic changes could potentially wipe out or significantly depress the future equity risk premium has been debated. Using economic growth and asset-pricing theories, Cornell [2012] concludes that the future equity risk premium should not be affected by the perceived investment behavior of baby boomers. Similarly, Imlanen [1996, 2011], among others, has accepted rewards for bearing interest rate risk as a risk premium.

In contrast, the investment community is still working on understanding some of the alternative risk premia. The value premium is an illustrative example. To gain value-premium exposure, some investors must be willing to sell the stocks that the value premium investor would like to buy and to buy the stocks that the value premium investor would like to short. The stock market and company stocks are all net long vehicles, so their short sales are capped. Therefore, not all investors can invest in the value premium at the same time. This holds true for all risk premia that are constructed as dollar-neutral long/short asset portfolios or securities. Every unit of value premium investment requires one unit of value premium sales. Unlike the traditional asset class premia, long/short risk premia have net zero supply. In other words, a long/short risk premium is a vehicle for swapping risk between two counterparties on opposite sides of those risks. But who pays the investor premium?

An exhaustive review of the literature is beyond our scope. A recent study by Stivers and Sun [2010], however, documents the countercyclical nature of the value premium. Winkelmann et al. [2012] analyze asset exposures to macroeconomic risk, defined as the change in asset values due to persistent shocks to real economic growth. Perhaps some of these alternative premia have different term structures and profiles of their exposure to macroeconomic risks, such that investors with different or non-synchronized risk appetites swap these risk premia with one another. More research is needed to answer these important questions definitively and shed more light on the sustainability of these premia. Regardless of their true economic efficacy, their supply is limited. Not every investor can invest in them, unlike traditional asset class risk premia.

It is also worth investigating how the popularity of these alternative risk premia may drive the security behavior. Barberis, Shleifer, and Wurgler [2005] provide a more comprehensive discussion on why assets move together. Evidence suggests that the correlations of stocks categorized in the same groups tend to be higher. For instance, Mezrich and Ishikawa [2013] argue that, since the launch of the sector classification system known as the Global Industry Classification Standard (GICS), correlations among stocks assigned to the same GICS sector trended higher, likely because these constituent clusters are often bought or sold together as a group. If alternative risk premia investing becomes more popular, we may observe that correlations among the constituents of their long or short components trend higher. Correlations between the long component’s constituents and the short component’s constituents may drop, however, because of their opposing long/short nature. Higher correlations between constituents within the long and short components, together with the negative correlation between the two components, imply that the popularity of an alternative risk premium can push its own volatility higher, if everything else is equal.

Investing in alternative risk premia requires dynamic trading, and implementation is not a trivial consideration. Again consider value and momentum premia as examples. A value-premium portfolio is not static, as stocks considered value today cannot remain so forever. Instead, stocks come in and out of value percentile portfolios, and evidence suggests that some degree of the realized value premium is a result of migration. Likewise, stocks in the long component of the momentum premium portfolio must drop out eventually, or else these stocks’ persistence as winners would eventually drive them to dominate the entire stock market. Therefore, dynamic trading is necessary, and its implementation can distinguish one manager from another, as there is no standard rebalancing or trading policy for any of these premia.

The need for dynamic trading leads to the next question of implementation: Is it better for a single portfolio manager to manage multiple risk premia within one portfolio, or for multiple portfolio managers to each managing a single risk-premium portfolio? Aside from the flexibility that lets investors, rather than the single manager of multiple risk premia, determine their preferred allocations to different premia, a multiple man-
manager approach can provide a cleaner look at how each premium performs. This comes at the expense of potentially higher implementation costs. Such an approach may also require much more support, given limited synergies across certain support functions, such as back office. Besides, the oft-cited benefit of better diversification, or lower correlations among these alternative risk premia, can potentially lead to higher implementation costs. Consider the negatively correlated value and momentum premia pair as an example. Their negative correlation implies a higher chance that one premium portfolio will buy (or sell) the same security that another premium portfolio happens to be selling (or buying) at the same time, according to the often opposite security preferences their negative correlation implies. The multiple managers approach would execute the buy/sell trades of the same securities and pay all the associated costs. The single manager approach would net trades across all premia and could potentially realize significant savings on long-term implementation costs. Generally speaking, the lower the correlations among these premia, the greater the potential cost efficiency and savings a single manager approach may bring, everything else being equal. As the costs involved—both direct and opportunity—are not inconsequential, investors may need to be more thoughtful in balancing the pros and cons of different approaches.

The appropriate and realistic allocation of these alternative risk premia in a pension plan is a distinct asset allocation exercise. Given that the typical alternative risk premia have been known for a considerable period of time, it is likely that many asset managers have already made tilts toward some or all of these premia, even in traditional, long-only portfolios. Alternative risk premia investing may therefore be considered as a matter of allocating a higher tracking-error budget to an asset manager (possibly in place already) who has been tilting towards these premia. To that end, product frameworks such as 130/30 can be viewed as a step toward greater investment in some of these risk premia, by both allowing a higher tracking-error budget and relaxing some degree of the constraints forbidding shorts and leverage.

CONCLUSION

Portfolio efficiency may be improved with innovations in the form of 1) introducing new assets that offer non-replicable, non-redundant return and risk characteristics; 2) deriving new asset-pricing theories that help determine the values of existing assets and therefore improve forecasts of asset returns and risks; 3) developing new portfolio-construction methodologies that may further push the resulting portfolio towards the efficient frontier. Combinations of these, among themselves or with others, may also improve portfolio efficiency.

Recent innovations, such as risk parity and risk premia investing, do not introduce new assets into the universe, nor are they new asset pricing theories. Given a fixed universe of investable assets, the maximum achievable portfolio efficiency is defined, although the efficient frontier cannot be known ex ante. If these newer ways of investing do improve portfolio efficiency, their value proposition seems to fall more into the third category of improved portfolio construction. Both approaches are linear transformations of the existing assets, such as selected constituents in asset classes that include stocks, bonds, commodities, and the like, but with new elements that include leverage, shorts, and dynamic trading. The superiority of these approaches largely build upon the well-established finding that a constrained efficient frontier is less efficient than an unconstrained efficient frontier, everything else being equal. Although neither the risk parity nor the risk premia approach is a magic bullet, at the very least they may provide improvements in portfolio efficiency by removing the frictions caused by constraints on leverage and shorts which may prevent the investor from getting closer to the efficient frontier.

No matter how we rotate the Rubik’s cube into different color combinations, it is the same cube. We can, however, make it a better cube by reducing the frictions of rotation.

ENDNOTES

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1 See Malmendier and Nagel [2011] and Greenwood and Schleifer [2012] for examples.
2 See Lee [2011] for a critical review of these often labeled as risk-based portfolios.
3 Practitioners have also implemented tail-risk parity.
For examples, see Lee [2011] and Jurczenko, Michel, and Teiletche [2013] on required investment beliefs that make the risk parity portfolio mean–variance optimal. Kaya [2012] in particular emphasizes the forecast errors management nature from a Bayesian perspective behind the risk parity portfolio’s optimality.

A portfolio’s return and risk may not grow linearly with leverage for a number of reasons, such as cost of leverage, transaction costs, and others. See Sebastian [2012] and Anderson, Bianchi, and Goldberg [2012] for discussions on the potential limits of leverage.

See Merton [1994].

See Page and Taborsky [2011] for examples.

Some practitioners have buckets labeled “real” and “deflation.” Strictly speaking, the concepts of inflation, real, and deflation are related, but some investment management industry practices remain pragmatic and at times may not be entirely precise.

See Fama and French [2007] for details.

For example, with the returns, risks, and correlations among these alternative risk premia and equity, as reported in Ilmanen and Kizer’s [2012] Exhibits 6 and 7, an 8% volatility portfolio would allocate 20% to carry, 80% to trend, and 0% to equity and others. The optimal allocation for a 10% volatility portfolio is 100% to trend.

Tol and Wanningen [2011] discuss how the 130/30 structure may improve the information ratio by allowing the incorporation of more investment insights into the portfolio.

REFERENCES


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