

# RISK PARITY: IN THE SPOTLIGHT AFTER 50 YEARS

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## Introduction

Risk Parity is a simple idea: maximize diversification by taking equal risk in each investment. This concept can be used to guide portfolio diversification, by decreasing assets with large shares of the investment risk budget and increasing lower-risk assets. In practice, risk parity is used in an increasing number of investment strategies, and can even be pursued at the total portfolio level. Most risk parity approaches involve leverage, which has made recent headlines, with reporters questioning the logic behind gearing low risk assets to increase return. However, this approach is actually an insight that is more than 50 years old.

Harry Markowitz introduced the concept of the “efficient frontier” in 1952. Using assumptions for expected return, standard deviation of return, and correlations between assets, the efficient frontier is a graphical depiction of the highest expected return possible for a given level of risk. Bill Tobin and others pointed out in 1958 that the frontier can be improved upon by adding risk-free investments to the total portfolio. To the left of the frontier, an allocation on the efficient frontier (the tangent portfolio) is combined with risk-free assets (generally cash or Treasuries) to create a line – dubbed the “capital market line” – that represents portfolios with higher returns for a set level of risk than those on the frontier.

The capital market line also extends to the right and above the frontier. Tobin showed that leveraging a well diversified and low-risk portfolio produces a risk/return trade-off superior to that of an unlevered traditional portfolio concentrated in risky assets. Put differently, an investor

can achieve expected returns above the efficient frontier by allowing the portfolio to be levered.

Despite the soundness of Tobin’s idea, the use of leverage by institutional investors has long been considered taboo. Many investors have a greater awareness of the potential dangers of leverage than an appreciation of its benefits when prudently used. They may dismiss the idea of leverage out of hand, without assessing its pros and cons. But attitudes are shifting. Investment pro-

## THIS APPROACH IS ACTUALLY AN INSIGHT THAT IS MORE THAN 50 YEARS OLD.

fessionals in particular are increasingly aware of the constraints on portfolio performance imposed by arbitrary restrictions on style, geography, shorting, and leverage.

More open attitudes about moderate leverage have led managers to develop products which exploit Tobin’s insight. Many of these products come under the name “risk parity.”

## Diversification

Diversification has always been key to successful long-term investing. To measure the benefits of diversification, metrics such as the Sharpe ratio, a measure of a portfolio’s excess return per unit of risk, were developed. What does a fully diversified portfolio look like? Using the tools mentioned above, we would look for the portfolio with the highest Sharpe ratio – specifically, the tangent portfolio in Figure 1. This portfolio has relatively

low risk; unfortunately, it is also one of the lowest returning portfolios on the frontier.

Broadly speaking, investors follow two main avenues to boosting returns: taking more beta (or market) risk along the frontier, and seeking alpha (or manager outperformance). The first technique, taking more beta risk, has led to portfolios with equity-heavy mixes that have concerned NEPC for many years. The second technique, pursuing alpha, is employed in a huge array of products, many of them quite successful, but is more expensive and fleeting than market beta exposure.

## AN ASSET ALLOCATION WITH 55% EQUITIES LEADS TO 85% OF RISK.

Yet there is a third way to increase expected risk and return, one that exploits the capital market line (CML) defined in the previous section. If investing and borrowing can be done at the risk-free rate, then this line can be drawn from the risk-free rate, tangent to the efficient frontier. Portfolios on the CML are more efficient than portfolios on the efficient frontier (Figure 1); that is, they achieve more return at a given level of risk. But to position a portfolio along the CML and increase risk and return, leverage is needed in order to invest more than 100% in the tangent portfolio. The Sharpe ratio for all portfolios on the CML is constant; an investor can simply choose the level of risk to be taken.

### Risk Parity

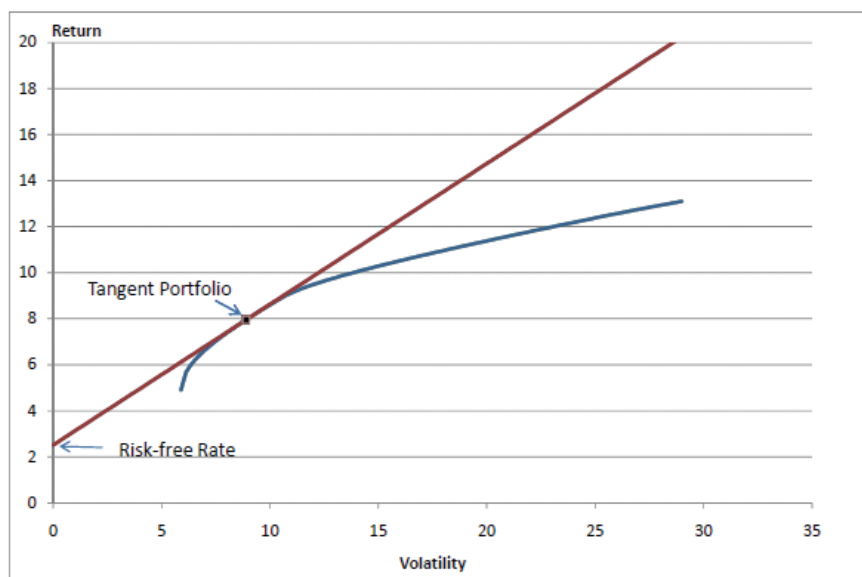
One simple way to diversify is to allocate equal capital to each asset class. Unfortunately, such an allocation is not efficient, and for that reason has been called “naïve diversification.” The tangent portfolio, in contrast, tends to have allocations that are equally risk weighted, leading to the term “risk parity.”

Risk budgeting can be used to calculate the risk allocations of a portfolio by asset class, based on the assumed volatility of each asset class and its correlations to other assets. We will examine a hypothetical asset allocation, first on the usual capital basis, and then on a risk basis. Figure 2 is an example of a typical risk budget, with a portfolio well diversified across liquid asset classes.

Notice that many of the portfolio’s diversifying asset classes each have a 5% allocation, yet their share of the risk budget ranges from 0% (rounded) for several to 9% for emerging market equities. Also, as NEPC has noted frequently, equity risk dominates the risk budget; in this case, an asset allocation with 55% equities leads to 85% of risk.

With this typical risk budget framework, we can construct a portfolio with risk parity – that is, one in which each asset class contributes an equal amount of risk. In essence, we “reverse-engineer”

Figure 1: Efficient Frontier with Capital Market Line



the process, starting with a portfolio of equal risks from each asset class and then deriving the underlying capital allocation. Figure 3 reveals the results of this exercise.

With ten asset classes, each is 10% of the risk budget, as shown in the bottom graph. From this we derived capital asset allocations as shown in the top graph. Some asset classes, such as core bonds, gain a greater share of capital due to their

relatively low volatility. The allocations of other asset classes, such as commodities, expand because of their low correlation to other kinds of assets.

This risk parity portfolio has an expected return of 5.9%, with a standard deviation of 6.9%, using NEPC's 2010 assumptions. Regardless of the risk-free rate, this portfolio has a Sharpe ratio that exceeds most institutional funds. Unfortunately, its expected return is lower than required by many programs. This brings us back to the use of leverage along the Capital Market Line.

If we lever this portfolio once, for 2:1 leverage, we increase the geometric return to 8.9% and the standard deviation to 13.9%. This is an attractive risk/return profile that would be acceptable to most investors, if they could become comfortable with the distinctive risks arising from leverage. This 1x leverage example is presented in Figure 4.

Figure 4 reveals the 2010 return and risk assumptions of the ten liquid asset classes used in the risk budgets, and the unconstrained efficient frontier of all combinations of these assets. Actually, we should note that the efficient frontier is based on all long-only, unlevered combinations of assets. The basic risk parity portfolio plots very close to the frontier, close to the tangent portfolio in Figure 1. Importantly, a risk budget methodology for creating the risk parity portfolio does not guarantee that it will have the maximum Sharpe ratio. However, we would expect either methodology to produce very similar results. As leverage increases along the line, the levered risk parity port-

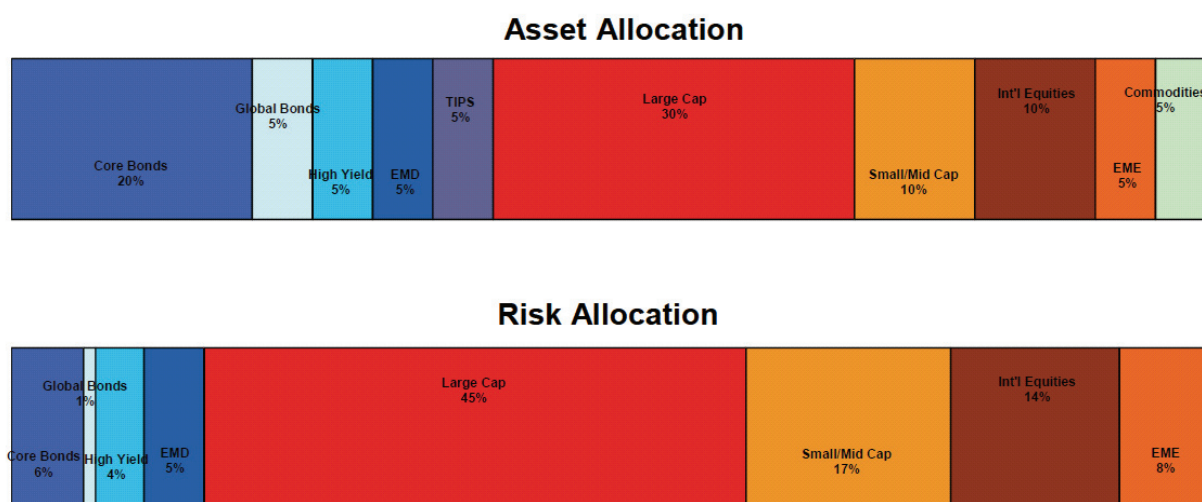
folio can achieve returns significantly above those of portfolios along the efficient frontier.

## Economic Scenario Method

Before discussing the risks and opportunities of leverage, we will examine another framework for creating risk parity portfolios. Instead of assessing prospective risks, returns, and correlations, this method aims to have investments that perform well across a variety of economic environments. The typical economic framework is based on projections of economic growth and inflation, very similar to those formulated by NEPC.

Specific historical periods can be tied to each of these inflation/growth regimes. For any given period, the performance of individual asset classes has varied widely, in large part due to the divergent dynamics of inflation and growth. For example, the United States and much of the rest of the world experienced unprecedented disinflation and strong economic growth during the 1980s and 1990s. These forces helped drive extraordinary returns for traditional stock and bond investments. In 2000–2002, a “perfect storm” of tumbling stock markets and lower interest rates was rough on equity markets and raised pension liabilities, but was good for bonds. The overextension of the 1960s and the stagflation of the 1970s witnessed high inflation. Traditional stocks and bonds fare the worst in times of stagflation, now considered by many observers as a plausible threat for the first time in 30 years.

Figure 2: Typical Asset Allocation with Risk Budget



From a portfolio construction standpoint, all three approaches to achieving risk parity – a levered tangency portfolio, an equally apportioned risk budget, and the economic scenario method – lead to similar portfolio allocations. Compared to the asset allocations of most programs and the relic of a “60/40” equity/fixed portfolio, risk parity portfolios have much less in equity, much more in inflation-sensitive TIPS and commodities, and greater international diversification. As we have discussed, such a portfolio carries much less risk, but (if unlevered) delivers lower returns than are generally required.

## Leverage

So why have investors seeking higher returns not leveraged a low-risk portfolio? The most likely reason is aversion to the very idea of leveraging. Leverage has been part of the downfall of many investment strategies and firms, notably during the recent credit crisis. A leveraged portfolio can lose more than 100% of invested capital. Leverage using margin or prime brokerage is much more expensive than borrowing at the risk-free rate. Finally, since few institutional investors use leverage at the portfolio level, there is maverick risk from being different.

As addressed in our paper *Looking into the Future Casts Shadows*, leverage is a problem when combined with other factors:

- Distressed sales: forced deleveraging triggered by asset losses or changes in borrowing rates or terms.

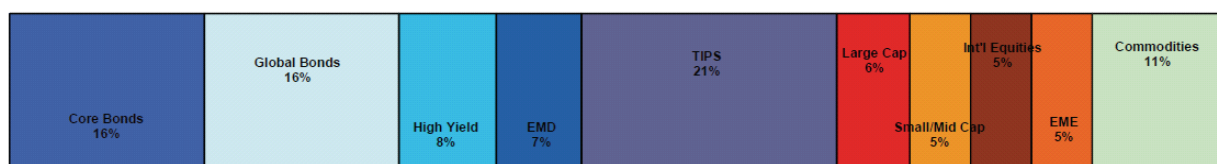
- Illiquidity: assets that are hard to sell, or that can be sold quickly only with a severe discount.
- Kurtosis, or “fat tails”: return distributions that have a hidden risk of large losses.
- High leverage: very high leverage can turn small underlying losses into catastrophes.

NEPC believes that these risks call for caution in deploying leverage in institutional portfolios. Yet it also presents an opportunity for institutional investors. Leverage remains a critical component of the market economy. Banks use fractional reserves to back commitments. Companies use operational leverage to trade off fixed and variable costs. Investors in a stock take on the risk of the issuer’s balance sheet leverage. More recently, NEPC has recommended liability-driven investment (LDI) strategies to its corporate clients; many such strategies use derivatives to efficiently match liability duration with limited plan capital. The tremendous growth of derivative markets presents an opportunity to use leverage efficiently; derivatives priced off LIBOR in effect allow institutional investors to borrow and lend at near a risk-free rate.

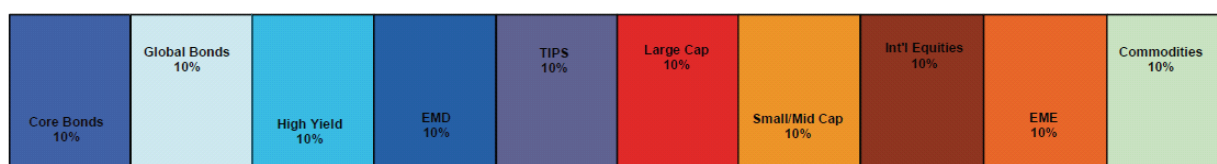
In our view, plan sponsors can benefit by regarding leverage as a potential investment tool whose risks and opportunities are worthy of evaluation. For some institutional investors, this may mean employing leverage at the portfolio level. The ultimate constraint on any portfolio is its limited total

Figure 3: Sample Risk Parity Portfolio with Risk Budget

### Asset Allocation



### Risk Allocation



capital. Leverage makes available much more capital efficiency than long-only investments, freeing up assets for alpha sourcing and necessary collateral management. This approach has been used very successfully by some endowments over the last several years.

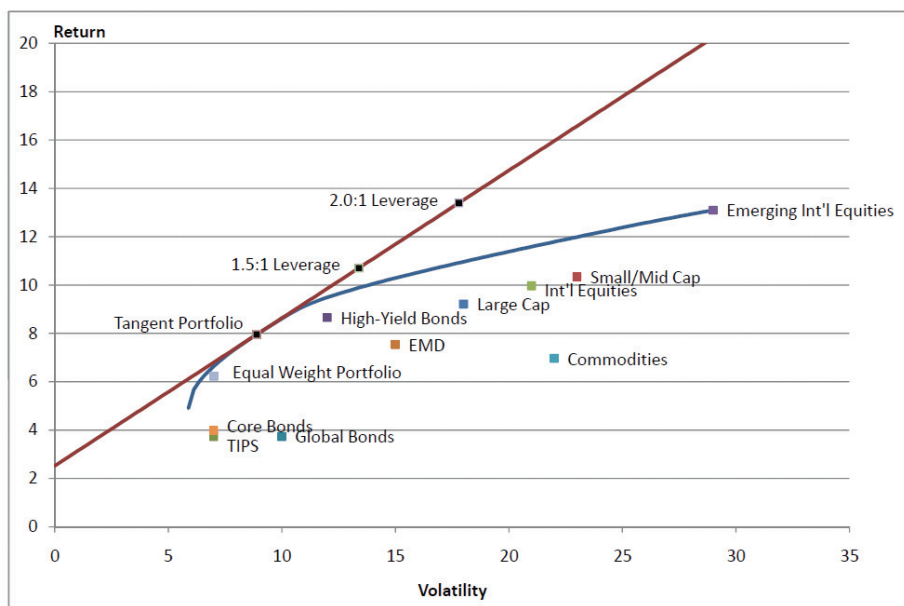
For many other investors, acceptance of leverage may mean finding a place for risk parity in a diversified portfolio. Fortunately, several investment managers have introduced risk parity products in recent years; indeed, many NEPC clients use such vehicles as alternatives to equity or within the global asset allocation sleeve of the portfolio. Risk parity products have expected returns similar to equity, with lower volatility and attractive diversification benefits. Those characteristics make them useful to plan sponsors in reducing equity risk without sacrificing expected return.

#### A Note on 2008

How did risk parity strategies fare during the massive financial market meltdown of late 2008? The worst market conditions since the Great Depression posed the most severe test of liquidity management for risk parity programs since their creation – a test that they passed. By investing in generally liquid markets with low leverage, managers

were able to avoid distressed sales and maintain exposure throughout the crisis. Counterparty management was also critical, and strengthened as a result of the crisis. Leverage ratios were cut

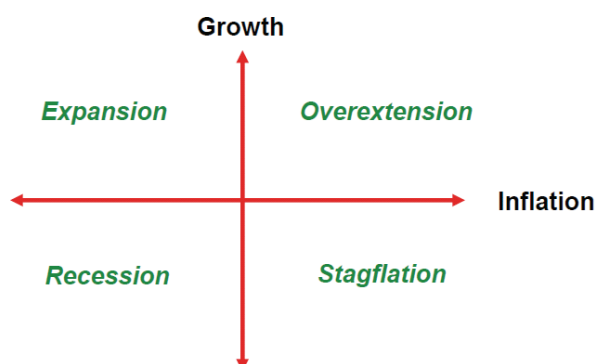
**Figure 4: Efficient Frontier with Levered Risk Parity**



back for most strategies, which we believe was appropriate. The performance of leveraged risk parity strategies in 2009 depended on the timing of increasing leverage back to long-term targets.

From a return perspective, although risk parity aims to protect in multiple economic environments, sudden and intense deleveraging across the financial system in late 2008 led to losses for all risky asset classes. Risk parity strategies typically include an allocation to global nominal sovereign bonds, which performed exceptionally well during the flight to quality. However, all other asset classes fell, leading to total 2008 risk parity returns of around -15% to -20%. This record is actually a compelling testament to the benefits of risk parity investing: the typical risk parity product, funded out of equity, experienced half of equity losses, while a total portfolio using risk parity lost less than two years of gains and has done exceptionally well in 2009.

**Figure 5: NEPC Economic Scenario Framework**



#### Summary

A 50 year-old insight is highly relevant and useful in today's investment environment. Risk parity uses basic investment tools: the efficient frontier,

risk budgeting, and scenario analysis. Leverage is a key component of successful risk parity portfolios and products, and the understanding and acceptance of leverage is a critical factor in adopting and managing a risk parity approach. Investors can use risk parity products to diversify away from equities without sacrificing expected return. Risk parity can also be used at the total portfolio level, to seek an optimal unconstrained market exposure. In NEPC's view, risk parity is a viable investment option for clients, helping them to deal with an uncertain future through the broadest possible diversification.

