

# Are Risk-Parity Managers at Risk Parity?

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In recent years, risk-parity managers have been popping up, as the Chinese saying goes, like bamboo shoots after a spring rain. In the case of risk parity, however, the “spring rain” was the tsunami of the global financial crisis, which delivered devastating losses to traditional capital-based asset-allocation portfolios and prompted a significant increase in investors’ interest in risk-based portfolios, such as risk parity.

The flood of new marketplace entrants has raised a question: Do these new offerings truly achieve risk parity as we know it? This is an important question to answer, because a portfolio at risk parity in name only may fail to provide the diversification and stable investment returns that investors expect from a risk-balanced approach such as risk parity.

We must address at least two issues to answer this question. First, there is no consensus on the definition and interpretation of the risk-parity principle. Second, there is no simple way to tell if a given strategy adheres to this principle. In this article, we aim to define the principle of risk-parity investing and then examine several risk-parity managers quantitatively using return-based style analysis. The results are revealing as well as surprising.

## WHAT IS RISK PARITY?

Risk parity is unique in its approach of using risk allocation in determining port-

folio weights. The original concept and outline of portfolio construction process can be traced to Qian [2005], which analyzed the unbalanced risk allocation of traditional 60/40 portfolios, with negative implications for portfolio losses, and proposed equal-risk allocation portfolios, coining the term “risk parity.” Qian [2006] established the financial interpretation of risk contribution and its connection to return contribution. Initially a quantitative concept in risk budgeting, risk parity has since evolved as an investment category in asset allocation and a portfolio construction technique broadly applicable to almost all investments. The concept of risk parity also includes fundamental consideration of macroeconomic risks.

The rapid development of risk parity has caused some confusion among practitioners and investors who generally believe in the approach’s merits, due to significant differences in interpretation and implementation. In this section we present a definition of risk parity as an investment approach, from the perspective of fundamental risks that affect asset allocation portfolio.

The best way to do this is to define what is not risk parity. A 60/40 stock/bond portfolio is not at risk parity. It has balanced capital, but is terribly unbalanced in risk allocation, having 90 to 95% of the portfolio’s risk in stocks [Qian 2011].

Portfolios constructed with risk budgeting are not necessarily at risk parity. A common example is a portfolio with equal risk allocation to all selected asset classes. Imagine a manager has chosen four equity asset classes and one fixed-income asset class in an asset allocation portfolio. An equal-risk-contribution portfolio would have 80% of its risk in stocks and 20% of its risk in bonds. That's perhaps an improvement over the 60/40 portfolio, but definitely not risk parity. Conversely, if the portfolio budgets risk equally between four fixed-income asset classes and one equity asset class, then an equal-risk-contribution portfolio is not at risk parity either.

This example illustrates that one should not treat risk parity blindly, as a mathematical exercise. It highlights the importance of parity along the right dimension. The most important dimensions, obviously, are not the number of assets or the asset class dimension.

A portfolio with equal risk allocation to select asset categories is not necessarily at risk parity either. Suppose the manager realizes the oversight and includes four fixed-income asset classes, to balance out the number of equity asset classes. The four fixed-income asset classes are high yield, emerging-market debt, inflation-linked bonds, and investment-grade bonds. An equal-risk-contribution portfolio from the eight asset classes does not achieve risk parity [Chaves et al. 2011], because three of these four fixed-income asset classes contain varying degrees of equity risk. High yield, for example, is almost all equity [Qian 2012]. As a result, this equal-risk portfolio is heavily skewed to equity and does not achieve risk parity.

The key word in risk parity is risk, not parity. A portfolio at risk parity, at a minimum, must have balanced risk allocation along the economic risk dimensions that have a major effect on portfolio returns. For asset allocation portfolios, the key risk dimensions are growth and inflation risk.

Risk premiums provided by different asset classes are associated with these risks. Along the growth risk dimension, there is equity-risk premium and interest-rate risk premium, which hedge each other when economic growth fluctuates. The inflation risk dimension offers real-return premium and nominal-return premium, which behave in opposite ways when the inflation outlook changes. When we risk budget these premiums together to achieve balanced exposure to growth and inflation risk, it is evident that a risk-parity

portfolio should have a balanced risk contribution from three sources: equity risk, interest-rate risk, and inflation risk.

Some asset classes are exposed to three risks directly. Stocks represent equity risk, nominal government bonds represent mostly interest-rate risk, and commodities represent inflation risk. In a way, as with red, green, and yellow as three primary colors, equity, interest rate, and inflation offer three primary risk premiums. Other colors, or hybrid asset classes, such as the four fixed-income assets previously mentioned are (to a large degree) blends of the three primary risk premiums.

## A STYLE ANALYSIS OF RISK PARITY

We have defined asset allocation portfolios at risk parity as portfolios that target balanced contributions from equity, interest rate, and inflation risks. We now examine seven risk-parity managers listed in the eVestment database by performing a return-based style analysis and mapping their effective asset allocation mixes to risk allocations.

Sharpe [1988, 1992] introduced return-based style analysis to analyze asset allocation and equity portfolios. The original technique is designed for long-only, unlevered portfolios; we have extended it to analyze long-only leveraged portfolios.

Our sample period covers three years from October 2009 to September 2012, during which monthly returns for all seven managers are available.<sup>1</sup> Many other risk-parity managers don't have enough history to complete the analysis. Although it is possible to stretch the sample period further back for a few managers, many risk-parity managers evolved their strategies after the global financial crisis of 2008. Therefore, data from the recent period might be a better representation of their current styles.

The choice of return indices also warrants some consideration. A choice of too few indices might not sufficiently cover all managers' investments. But too many indices might lead to multi-collinearity and overfitting. This may not be a problem, as far as risk analysis is concerned. Although the effective asset mix found from the style analysis is sensitive to the choice of asset indices, the final risk allocation to the three risk sources is rather robust. This is because changes in the effective asset mix tend to occur between asset classes that are highly correlated and represent similar type of risks from

## EXHIBIT 1

### Effective Asset Mixes of Seven Risk-Parity Managers, Total Leverages, and R-Squared of the Fit

	A	B	C	D	E	F	G
DJUBS	18%	7%	15%	25%	21%	13%	17%
BarCap US Tsy	0%	43%	66%	38%	65%	17%	0%
WGBI ex US	87%	93%	57%	93%	52%	9%	74%
BarCap MBS	0%	0%	0%	0%	0%	18%	7%
Citi US TIP	57%	79%	46%	29%	55%	50%	37%
BarCap Credit	30%	18%	7%	0%	0%	15%	0%
Citi EM Debt	0%	7%	0%	1%	0%	0%	14%
BarCap US HY	1%	0%	4%	0%	0%	8%	32%
S&P 500	0%	0%	8%	15%	4%	37%	2%
MSCI ex US	22%	11%	3%	0%	28%	19%	19%
Russell 2000	13%	9%	15%	5%	8%	0%	15%
MSCI EM	0%	2%	5%	0%	0%	1%	9%
Leverage	<b>228%</b>	<b>269%</b>	<b>226%</b>	<b>205%</b>	<b>232%</b>	<b>188%</b>	<b>225%</b>
R-squared	92%	94%	95%	82%	89%	96%	96%

a fundamental perspective. We opt to use a sufficient but not exhaustive number of return indices to produce a good fit for the style analysis.

Exhibit 1 shows the effective asset mixes for the seven risk-parity managers, labeled from A to G. The analysis includes 12 asset classes. For commodities or inflation risk, we use the DJ-UBS commodity index. Among the fixed-income asset classes, U.S. Treasury, MBS, and WGBI ex US almost entirely represent interest-rate risk; credit and emerging-market debt represent a combination of interest-rate risk and equity risk; TIPS represent a combination of interest-rate risk and inflation risk; and high yield can be categorized as equity risk. Four equity asset classes represent equity risk.

The style fit shown in Exhibit 1 is quite good. With the exception of manager D, the R-squared is either close to or above 90%. The leverage ratios are between 200% and 300%, except for manager F, whose leverage is 188%. Manager B has the highest leverage, at 269%. The leverage results confirm the use of leverage, as well as risk-parity strategies' common leverage level.

However, this leverage comparison is not indicative of the total level of portfolio risk. For example, 93% of manager B's portfolio is in the WGBI ex US index, which has a quite low return volatility. Manager F has an exposure of 65% in a combination of four equity asset classes and high yield. As a result, manager F's portfolio risk will be higher.

Furthermore, the fact that a portfolio (such as that of manager F) is levered and has substantial notional exposure to fixed-income assets does not necessarily prove that the portfolio is at risk parity. The use of port-

folio leverage to balance the risk allocation of risk-parity portfolios—a hotly debated issue—is often mistakenly taken as the defining signature of risk parity. Although portfolio leverage is often necessary for risk parity to achieve a risk level commensurate to expected returns, leverage alone is not a sufficient condition for an asset allocation portfolio to achieve risk parity.

Managers have common exposure to some asset classes and not to others. The common exposures seem to include commodities, global sovereign bonds, inflation-linked bonds, and global developed equities covering both large and small capitalization.

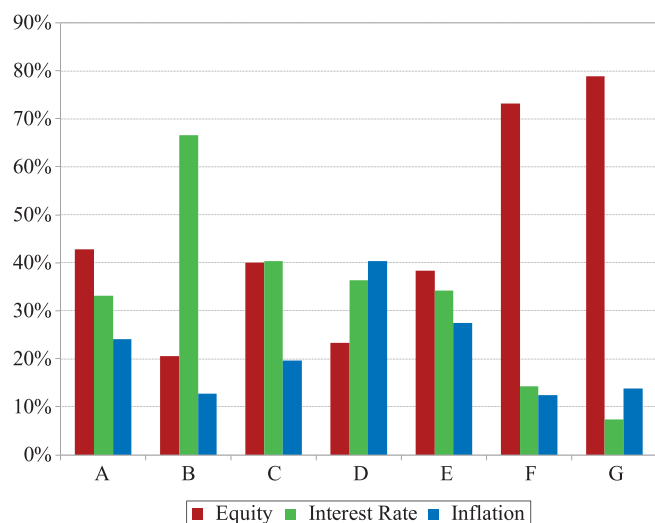
Given the effective asset mixes in Exhibit 1, we can derive the risk allocations to the individual asset classes, provided a covariance matrix of asset returns. Most risk-parity managers use various quantitative methods and long-term historic returns to compute covariance matrices. A covariance matrix based on the three years of returns, used in the style analysis, is too short term and is susceptible to distortion introduced by the particular macroeconomic environment of that period. We thus use monthly returns covering a much longer period to calculate the covariance matrix and determine managers' risk allocation.

Once we know the risk allocation to asset classes, we combine them to find the risk allocation to the three risk sources: equity, interest rate, and inflation. Exhibit 2 shows the results.

Can these risk allocations be considered balanced? Managers F and G do not pass the test, because both maintain a very low risk allocation to interest-rate risk. Manager G, in particular, has a risk profile that is very

## EXHIBIT 2

### Risk Allocations to Three Risk Types



## EXHIBIT 3

### Risk-On Combines Risks in Equity and Inflation; Risk-Off Shows Interest-Rate Risk

	A	B	C	D	E	F	G
Risk-on	67%	33%	60%	64%	66%	86%	93%
Risk-off	33%	67%	40%	36%	34%	14%	7%

similar to that of a 60/40 portfolio, with the exception that some of the equity risk is now diverted to inflation risk.

In Exhibit 3, we also aggregate equity and inflation risk into “risk-on” risk, and label interest risk as “risk-off” to reflect the risk-on/risk-off market phenomenon of 2009 to 2012, whereby many risky assets, including equities and commodities, moved in tandem and most sovereign bonds moved oppositely. From this perspective, the 93/7 split between risk-on and risk-off makes manager G no different than a 60/40 manager.

Manager F’s risk profile is similar, with only 14% in interest-rate risk and 86% in equity and inflation risk combined. From a risk allocation perspective, it becomes apparent that both manager F and G are heavily exposed to equity or growth risk, with no meaningful difference to the traditional 60/40 portfolio.

Yet manager F and G have significant notional exposures to fixed-income assets and sizeable portfolio leverages. There are three reasons for this. First, some of the interest-rate exposure has very low risk. For

instance, WGBI ex US index has the lowest return volatility among all assets. Second, as previously discussed, many other fixed-income exposures have embedded equity risk. Third, they also have high notional weights in equity assets. For these reasons, and perhaps against appearances, managers F and G are not at risk parity.

Manager B is not at risk parity in the opposite way. This manager’s interest-rate exposure accounts for 67%, or two-thirds, of the risk budget, while equity risk and inflation risk account for just 21% and 13%, respectively. The portfolio’s effective asset allocation mix has low weight in equity assets (22%) and commodities (7%) and very high weights in both nominal and inflation-linked bonds. The aggregate risk-on risk is only 33%. Manager B’s portfolio is not at risk parity. This is a significantly more conservative portfolio, tilted toward fixed income and with limited exposure to equities and commodities.

Exhibit 2 shows that the remaining four managers, A, C, D, and E, all have rather balanced allocations to three types of risk. They range from 20% to 40% in each risk. While this group shares more similarity in their risk profiles, manager A appears the most growth oriented, with 67% in risk-on/risk-on assets. Manager C appears the least growth oriented, with 60% of risk attributed to risk-on assets.

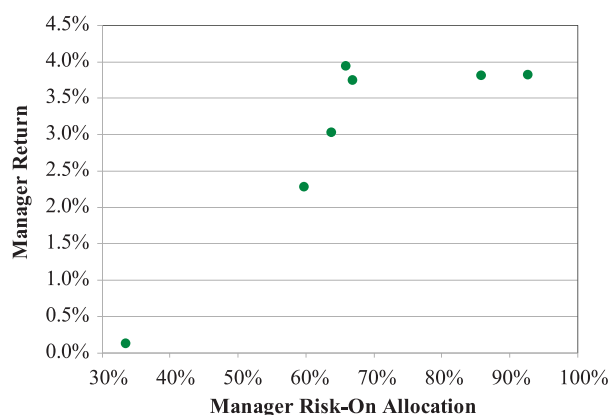
## RETURN “TESTS” OF RISK-PARITY MANAGERS

The style analysis and breakdown of risk allocation to equity, interest rate, and inflation risks might appear abstract, but they have strong practical implications for portfolio behavior. Managers who target higher allocations to equity and inflation risks would have performed well in risk-on markets but did poorly in risk-off markets. In contrast, managers who target a higher allocation to interest-rate risk would have performed well in risk-off markets but lagged in risk-on markets. This is especially true when the markets are volatile, whether they are up or down. In this section, we link our risk-allocation analysis to managers’ performance in different market environments.

The sample period of three years provide many test cases for our prediction. We use December 2010 as the risk-on case, when risky assets rallied strongly

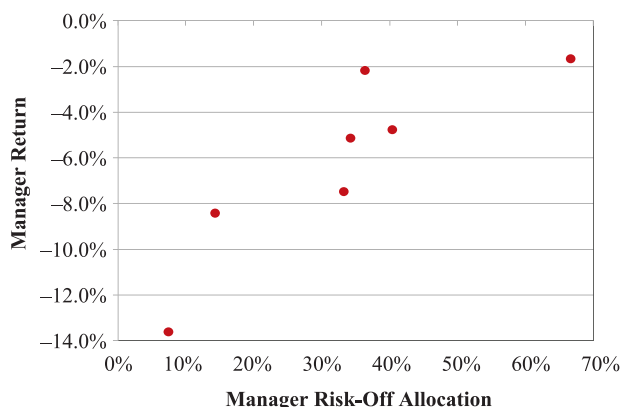
## EXHIBIT 4

### Managers' Risk Allocation to Risk-On Assets and Their December 2010 Performance



## EXHIBIT 5

### Managers' Risk Allocation to Risk-Off (interest-rate risk) and Their Performance in August and September 2011



and government bond yields rose significantly. For the risk-off case, we use August and September 2011, when risky assets suffered severe losses and U.S. Treasury yields reached new lows. Our analysis indicates that there should be a strong correlation between managers' risk allocations and their December 2010 returns.

Exhibit 4 plots the risk allocation to equities and commodities versus their returns in December 2010. There is a strong correlation between the two. Managers with the least amount of exposure to risky assets have the lowest return, while managers with the highest exposure to risky assets attain the highest returns.

Exhibit 5 plots risk-off allocations versus managers' returns in August and September 2011. Once again, managers with very low risk allocations to defensive assets suffered the most losses, while the manager with the highest risk allocations to defensive assets only had minimal losses. In those two months, the traditional 60/40 portfolio with 60% in the MSCI World index and 40% in the WGBI index was down -6.6%. In other words, managers F and G actually significantly underperformed the risk-concentrated 60/40 portfolios. This indicates that both managers have not achieved risk parity. These event studies provide strong validation for our return-based style analysis and risk-allocation decomposition to three risk sources.

## CONCLUSION

Risk parity as an alternative asset-allocation approach differs from traditional capital-based approaches by balancing risk allocation from various sources. Because its implementation has considerable freedom—the concept of risk parity is open to different interpretations and misinterpretations—it is hard for investors to tell the difference between various approaches.

In this article, we argue that a portfolio with true risk parity should have balanced risk exposure to the economic risks of growth and inflation. As a consequence, it should have balanced (but not necessarily equal) risk contribution from three risk sources: equity, interest rates, and inflation.

Measured against this criterion, we examine seven risk-parity managers listed in the eVestment database with return-based style analysis and find that at least three managers have investment styles that are significantly different from what we consider risk parity. Two of these managers have dominant equity or growth-risk exposures that are reminiscent of the traditional 60/40 portfolios, while another manager has interest-rate exposures that are more concentrated than what risk parity would imply.

Given these results, it is interesting to ponder why some risk-parity managers do not practice true risk parity. One simple possibility is a misclassification or misreporting of investment strategies. Another possible reason is some trivial misunderstanding of the risk-parity principle, either parity in asset number or parity in the asset categories, that could lead to an unintended risk

concentration in risk dimensions based on economic fundamentals.

It's also possible that some managers have intentionally made a strategic decision to significantly overweight one risk type over others. For example, rising interest rates were a common prediction for many years after the global financial crisis. Maybe some risk-parity managers have made this view a dominant theme of their strategic allocations.

Even if this were the case, however, the magnitude of their active decisions, inferred from their risk concentrations in both equity and inflation risks, seems extraordinary. On the contrary, the manager with a concentration in interest-rate risk could be expressing a strategic preference for quality fixed-income assets, relative to growth-oriented assets.

Our analyses thus show that a product's name, leverage use, and even use of risk budgeting does not necessarily mean that a portfolio adheres to the principles of risk parity. Investors must closely assess both the strategic and tactical allocations made in a portfolio that claims risk parity. Our analysis suggests that not all managers keep the risk balance that investors likely expect in their risk-parity portfolios. As our case study shows, the lack of balance, while not obvious on the surface, has important implications for the portfolio's ability to provide stable returns across various macroeconomic and market conditions.

## ENDNOTE

<sup>1</sup>One manager stopped reporting in June 2012.

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