Investment Insight

Are Risk Parity Managers Risk Parity (Continued)

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In the November 2012 Investment Insight[1], I presented a style analysis of seven Risk Parity managers and derived each manager's effective asset weights based on their monthly returns from the eVestment database as well as a set of traditional asset index returns. At the time, I found an excellent in-sample fit with an average R-square above 90%. Another startling discovery from the analysis was that three out of the seven managers were not truly at Risk Parity because their risk allocations to the three primary risks (equity, interest rate, and inflation) were not as balanced as implied by the Risk Parity approach. On the surface, all managers appeared to be Risk Parity, with significant notional weights in fixed income assets and substantial portfolio leverage. A more detailed risk analysis revealed that two managers held strong equity biases due to their concentration in growth assets (stocks and low-grade bonds) and one manager had strong interest rate bias due to its concentration in high-grade bonds.

A year has since passed since the original analysis. A natural question is: ***how accurate is the style analysis out-of-sample?*** In this follow-up note, I evaluate the prediction of the style analysis against the actual performance of the universe of Risk Parity managers and find ***strong agreement between the two***. First, on both an individual and aggregated basis, the return predictions are quite accurate. Second, in a period when equity risks had strong positive rewards while interest rate risks delivered weak or negative returns, the risk analysis correctly identifies the underperformance of the manager who had a concentrated interest rate risk allocation.

The analysis presented in this research note indicates that the effective asset mixes are reasonably accurate in predicting future returns. If so, they could serve, to some extent, as a proxy of strategic benchmarks for Risk Parity managers. The real time performance during the out-of-sample period, albeit a short one, provides investors an opportunity to evaluate their performance against these proxy benchmarks.

Summary Results of the Style Analysis

Exhibit 1 Effective asset mixes of six Risk Parity Managers, total leverage and R-squared of the fit

	A	B	C	D	E	F	AVG
DJUBS	18%	7%	15%	25%	21%	13%	16%
BarCap US Tsy	0%	43%	66%	38%	65%	17%	38%
WGBI x US	87%	93%	57%	93%	52%	9%	65%
BarCap MBS	0%	0%	0%	0%	0%	18%	3%
Citi US TIP	57%	79%	46%	29%	55%	50%	53%
BarCap Credit	30%	18%	7%	0%	0%	15%	12%
Citi EM Debt	0%	7%	0%	1%	0%	0%	1%
BarCap US HY	1%	0%	4%	0%	0%	8%	2%
S&P 500	0%	0%	8%	15%	4%	37%	11%
MSCI x US	22%	11%	3%	0%	28%	19%	14%
R2000	13%	9%	15%	5%	8%	0%	8%
MSCI EM	0%	2%	5%	0%	0%	1%	1%
Leverage	**228%**	**269%**	**226%**	**205%**	**232%**	**188%**	**225%**
R-squared	**92%**	**94%**	**95%**	**82%**	**89%**	**96%**	**91%**

For illustrative purposes only. Source: PanAgora.

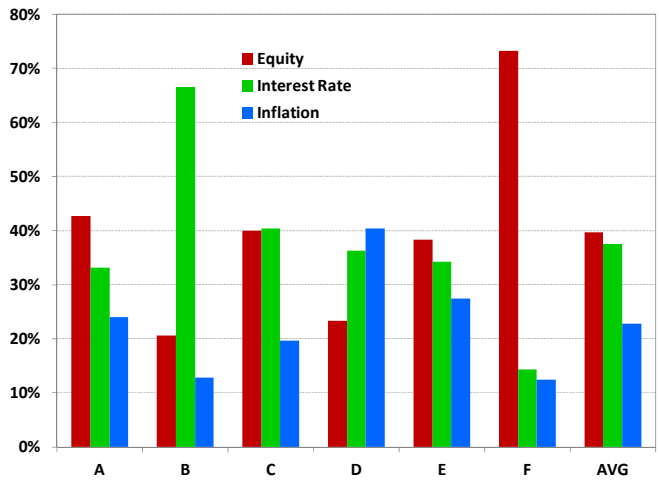
[1] Edward Qian, "Are Risk Parity Managers Risk Parity?", PanAgora Investment Insight, November, 2012

Exhibit 1 shows the result of the effective asset mixes from the previous style analysis[2]. Exhibit 1 also provides the average asset weights.

On average, these six managers have the following exposures: 16% in commodities, represented by the DJ-UBS index; 174% in bonds, most of which is in US Treasuries (38%), non-US government bonds (65%), and US TIPS (53%), as well as 34% in equities, represented by US and non-US developed market stocks and US small cap stocks. The average allocation to MBS, EM debt, EM equity, and High Yield bonds is very low. The average leverage is 225% and the average R-squared is 91%.

While the style analysis has excellent overall fit, we should not expect that it is accurate in all asset class weights. For example, I strongly suspect that the effective weights in EM debt and EM equity are lower than the actual weights taken by managers. However, these shortfalls are probably offset by weights in other equity asset classes offering the same risk exposure. The crucial question is the accuracy of the return forecasts based on these effective asset weights.

Exhibit 2 Risk allocations to three risk types



For illustrative purposes only. Source: PanAgora.

From the perspective of risk analysis, we group risk allocations, derived from the style weights, into equity, interest rate, and inflation risks. The results are shown in Exhibit 2. On average, the risk allocations to both equity and interest rate risks are 40% and 37% respectively, while the risk allocation to inflation risk is around 23%. These risk exposures are in general balanced since Risk Parity approach doesn't mean they have to be equal. Two managers have very different risk profiles, however. Manager B shows significant risk concentration in interest rate risk while manager F shows significant risk concentration in equity risk. Consequently, we would expect the returns of these two managers to deviate from the rest and specifically from each other, depending on different market environments. Will this be true out of sample?

The Out-of-Sample Market Environment

Our style analysis essentially provides models for the six Risk Parity managers. These models are estimated over three years of return data ending in September 2012. The out of sample period covers one year, beginning in October 2012 and ending in September 2013. While this subsequent period was not great for Risk Parity strategies in general, one could hardly ask for a better market environment for the purpose of testing asset allocation models. Moreover, the behavior of asset returns during this period is remarkably different from the behavior of asset returns during the three-year in-sample period.

First of all, this period is marked by sharp movements in bond yields. Government bond yields reached historically low levels in the early months of 2013 and then rose sharply in May and June of 2013. Since Risk Parity managers typically have a substantial allocation to interest rates, the interest rate volatility over this period was particularly impactful to their performance. How would the models from the style analysis track the actual performance of the managers in this interest rate environment?

Second, May and June of 2013 saw large drawdowns in Risk Parity portfolios because most assets or risks delivered negative returns. Naturally, one wants to see how our predictions pan out in this extreme market environment.

[2] One of the managers (manager G in the original study) had stopped reporting, thus we exclude it from the current analysis.

Thirdly, returns from different asset classes deviated strongly from each other, during the out of sample period, with equity delivering the best performance. This would likely accentuate the differences between Risk Parity managers with different risk allocations.

Exhibit 3 shows the one-year cumulative returns, the annualized monthly return standard deviations, and their Sharpe ratios of the asset indices over this out of sample period. Developed equity markets and high yield bonds had the best results in terms of both return and Sharpe ratio. Real assets such as commodities and inflation-linked bonds had the worst results. Fixed income assets had negative returns with the exception of the World Government Bond ex US Index. Of course, these cumulative statistics do not reveal some of the dramatic monthly movements of the markets, such as those in May and June of 2013. We shall discuss these specific months also in the paper.

Exhibit 3 Summary of returns, risk, and Sharpe ratios from October 2012 and September 2013

	Return	Stdev	Sharpe
DJUBS	-14.4%	32.5%	-0.44
BarCap US Tsy	-2.2%	9.4%	-0.23
WGBI x US	2.1%	9.5%	0.22
BarCap MBS	-1.3%	8.8%	-0.14
Citi US TIP	-7.0%	22.0%	-0.32
BarCap Credit	-2.0%	16.6%	-0.12
Citi EM Debt	-4.2%	29.9%	-0.14
BarCap US HY	7.1%	15.5%	0.46
S&P 500	19.3%	31.3%	0.62
MSCI x US	22.2%	30.9%	0.72
R2000	30.0%	41.8%	0.72
MSCI EM	0.9%	40.6%	0.02

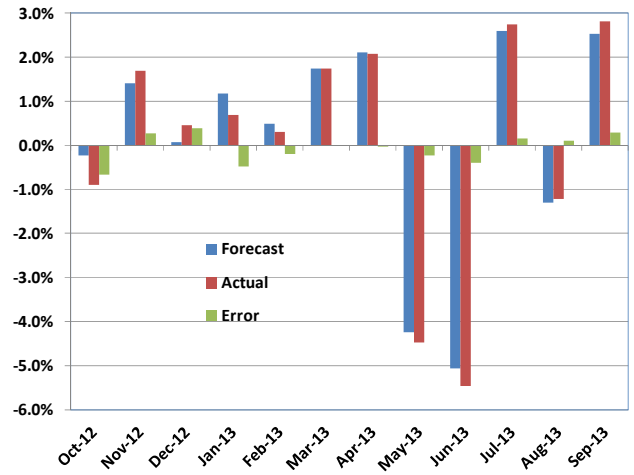
For illustrative purposes only. Source: PanAgora.

The "Average" Risk Parity Manager

We can model the "average" Risk Parity manager by utilizing the average asset allocation from the style analysis, displayed in Exhibit 1. We compare the performance of this portfolio to the average of actual returns from October 2012 to September 2013.

Exhibit 4 displays the two return streams, together with the error of the forecasts. We note that the forecast model accurately predicts the average returns of managers throughout the entire period. The errors are quite small compared to the actual returns. Indeed, the annualized tracking error is just 1.16%. In addition, the mean of error on a monthly basis is just -0.07%, or negative 7 basis points, which is statistically insignificant. Moreover, the errors in May and June of 2013 are equally small. We also note that the predicted cumulative return for the year is 91 basis points and the actual return is 4 basis points. Therefore, on average, the six Risk Parity managers underperformed the average style benchmark only slightly, by 87 basis points. Thus, we conclude that the average model portfolio matched the average manager performance quite well.

Exhibit 4 Forecasted and actual monthly returns of average managers



For illustrative purposes only. Source: PanAgora.

Individual Risk Parity Managers

We now look at the efficacy of the style analysis to predict individual manager returns over the same out of sample period. From a statistical perspective, it is expected that the style models for individual managers can't match the average model for the "average" manager. Regardless, we evaluate the fit of the style analysis for each manager by measuring the monthly residual between actual manager performance and predicted manger performance.

The first consideration is the accuracy of the forecasts. Exhibit 5 shows the mean and standard deviation of the monthly errors. The means range from -0.3% to 0.3% and the standard deviations range from 0.6% to 0.8%. These error terms, while not as good as the average forecast for the average manager, are still excellent. For

example, the standard deviation of errors is much smaller than the standard deviation of actual returns. Also the t-stat of the mean does not indicate a significant bias in the forecasts.

Exhibit 5 Mean and standard deviation of monthly forecasting error and the related t-statistics

	A	B	C	D	E	F
Average	-0.3%	-0.2%	0.3%	0.2%	-0.3%	-0.2%
Stdev	0.8%	0.6%	0.6%	0.8%	0.7%	0.8%
t-Stat	-1.39	-0.95	1.51	1.07	-1.30	-0.68

For illustrative purposes only. Source: PanAgora.

The second and alternative consideration is the relative performance of managers against their style benchmarks. We emphasize that these style benchmarks are not actual benchmarks used by Risk Parity managers if they ever used any benchmark. There are many reasons that Risk Parity managers do not have a widely agreed upon reference benchmark. First, it is difficult to design Risk Parity benchmarks because Risk Parity portfolios are subject to different interpretations. In addition, they could have time-varying notional weights, a trait not shared by traditional benchmarks[3]. But nevertheless, our style analysis has captured a significant portion of the return variation in all managers. As a result, it is a reasonable analytical exercise to use a styled derived benchmark as a proxy to measure manager performance.

Exhibit 6 The value added and tracking error of actual performance versus the style benchmark from October 2012 to September 2013

	A	B	C	D	E	F
Value Added	-4.0%	-2.1%	3.6%	3.0%	-3.2%	-2.1%
Tracking Error	2.8%	2.1%	2.2%	2.7%	2.4%	2.9%
Information Ratio	-1.44	-0.99	1.60	1.12	-1.35	-0.72

For illustrative purposes only. Source: PanAgora.

Exhibit 6 shows the value-added and tracking error of the six managers. The tracking errors range from 2.1% to 2.9%, which are not very different from in-sample tracking errors. However, the value added, or loosely termed alphas show greater variation, ranging from -4.0% (manager A) to 3.6% (Manager C). As a consequence, the information ratios have a wide range as well, with Manager A delivering an IR of -1.44 and Manager C delivering an IR of 1.6.

Of course, it is hard to precisely know the underlying causes for these relative performances. Some of the plausible reasons are: 1) style benchmarks are not precise; 2) tactical shifts by managers; 3) deviation from traditional indices in underlying asset class exposures; 4) volatility timing by managers.

Exhibit 7 Cumulative predicted and actual returns from October 2012 to September 2013

	A	B	C	D	E	F
Prediction	2.23%	-1.92%	0.21%	-0.71%	0.81%	4.88%
Actual	-1.94%	-4.02%	3.65%	2.28%	-2.52%	2.85%

For illustrative purposes only. Source: PanAgora.

In spite of these drivers of prediction error, the model performed reasonably well. Exhibit 7 shows the two sets of return numbers, one for the predicted returns and the other for the actual returns. First, we note the correlation between the two is positive 0.36, indicating the overall ranking of managers is preserved.

Second, consistent with our risk analysis shown in Exhibit 2, and realized performance of asset classes shown in Exhibit 3, the model predicts manager F would have had the best performance (4.88%) and manager B would have had the worst performance (-1.92%) since the former has a strong bias toward equity risk and the latter has a strong bias toward interest rate risk. The predicted spread is close to 7%. In reality, both managers trailed their model portfolios by roughly 2% so the actual spread proved to be close to the predicted spread of 7%. If one had thought that all Risk Parity managers are a homogeneous group, this kind of return dispersion would dispel that notion.

Third, among the other four managers, our risk analysis (Exhibit 2) also shows manager A has slightly more equity risk exposure than the other three. This is validated by Manager A's predicted return of 2.23% shown in Exhibit 7. However, manager A underperformed the model by more than 4%.

[3] There is no commonly known benchmark for Risk Parity. Some use cash plus a predetermined return, while others use various 60/40 portfolios as long-term benchmarks.

Lastly, managers C, D, and E, are very similar in terms of their risk allocation. Indeed, their model returns are also very similar however, manager C and D had positive "alpha" while manager E had negative "alpha".

Drawdown Prediction

The last case we shall consider is the prediction of style analysis for May and June of 2013 – a period when Risk Parity strategies in general suffered large drawdowns. Drawdown scenarios are not only of practical importance in risk management, but they are also critical to the theoretical validation of risk models.

Exhibit 8 Predicted and actual returns for the month of May and June 2013

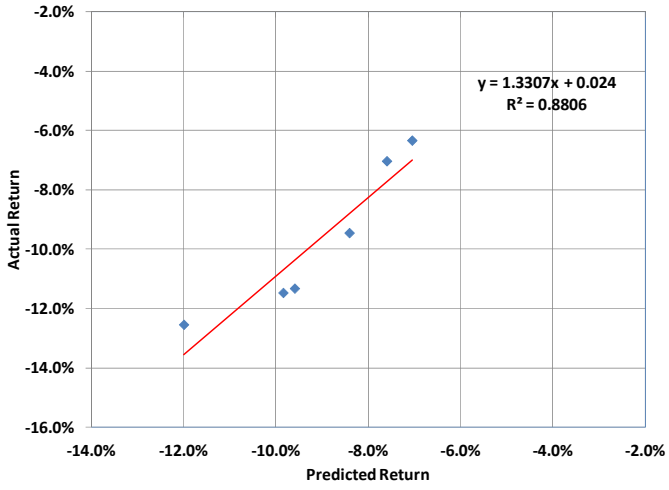
	A	B	C	D	E	F
Prediction	-9.8%	-12.0%	-8.4%	-7.1%	-9.6%	-7.6%
Actual	-11.5%	-12.5%	-9.4%	-6.3%	-11.3%	-7.0%
Difference	-1.6%	-0.5%	-1.0%	0.7%	-1.7%	0.6%

For illustrative purposes only. Source: PanAgora.

Exhibit 8 shows the predicted returns based on the style weights and the actual returns from the managers. The prediction is extremely accurate. For example, the prediction for the worst performer (manager B) is -12.0% while the actual performance is -12.5%. Similar precision is true for manager D and F, the two best performers. In hindsight, it is rather apparent why manager B performed much worse than others during this period; manager B's portfolio had a significantly higher risk allocation to interest rate risk and moreover it had the highest notional exposure to inflation linked bonds, which was the worst performing asset class. On the other hand, manager D and F benefited, at least on a relative basis, from their higher risk allocations to commodities and equities, respectively. Both commodities and equities, on a risk-adjusted basis, did better than interest rates in May and June of 2013.

The correlation between the predicted and the actual returns was 0.94. Exhibit 9 provides a graphical illustration of the results. The two sets of numbers are close to fitting on a straight line. The R-squared of the fit is 88%. The rank of predicted returns is perfectly preserved in the actual returns. From any perspective, the prediction during this drawdown period appears to be a remarkable success, lending strong support to the validity of the style analysis.

Exhibit 9 Predicted and actual returns of six managers during the months of May and June 2013



For illustrative purposes only. Source: PanAgora.

Summary

Risk Parity Multi Asset portfolios should have balanced, not necessarily equal, risk allocations to three primary sources of risks: equity, interest rate, and inflation. In a previous research note, we concluded that, based on return-based style analysis, some managers are not truly at Risk Parity due to their concentration bias towards one specific risk.

Reviewing one year of live performance since our original study, albeit a short window, has largely confirmed our results. First, the average model portfolio predicts the "average" Risk Parity manager with remarkable accuracy. One wonders if this model portfolio could potentially serve as a common benchmark for all Risk Parity managers. Second, with individual managers, while the tracking errors are larger, the results are generally satisfactory. For example, the model performance and the actual performance for the entire period have significant positive correlation. Moreover, the model correctly identifies the worst and best performing managers based on the style weights and market returns of underlying indices.

Lastly, for the months of May and June 2013, the style analysis was remarkably accurate in predicting managers' drawdowns. The risk allocation of managers

becomes the dominant factor in determining their absolute and relative returns in this period. For example, manager B had risk concentration in interest rate risk and suffered the most severe losses while manager F had risk concentration in equity risk and suffered the least losses.

In summary, these results suggest that return-based style analysis, combined with a proper risk-based allocation framework, provides valuable insights to investors in determining the true investment style of Risk Parity managers. In addition, it may also serve to identify common as well as individual benchmarks for Risk Parity managers.

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PanAgora did not manage actual Risk Parity Multi-Asset assets until January 2006. Historical performance (prior to January 2006) presented herein is purely theoretical and involves the application of PanAgora quantitative strategies to historical financial data to show what decisions would have been made if the strategy were employed. These backtested performance results are shown for illustrative purposes only and do not represent actual trading or the impact of material economic and market factors on PanAgora's decision-making process for an actual PanAgora client account. Backtested performance results were achieved by means of a retroactive application of a model designed with the benefit of hindsight.

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The information presented is based upon the following hypothetical assumptions: Hypothetical combination of the following nine strategies: Diversified Risk U.S. Large Cap Equity, Diversified Risk U.S. Small Cap Equity, Diversified Risk Non-U.S. Equity, Diversified Risk Emerging Markets Equity, Diversified Risk U.S. Term Structure, Diversified Risk Investment Grade Credit, Diversified Risk Non-U.S. Sovereign, Diversified Risk Inflation-linked Global, Diversified Risk Commodities. Weightings of the portfolio were adjusted over relative to forecasted Sharpe Ratios. Certain assumptions have been made for modeling purposes and are unlikely to be realized. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions used in achieving the returns have been stated or fully considered. Changes in the assumptions may have a material impact on the hypothetical returns presented.