Investment Insight

See the Forest for the Trees

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Risk Parity - a portfolio construction approach, when applied to asset allocation portfolios, balances the contribution of the targeted risk premiums from different asset classes. But balancing the risk contribution is not the objective of a Risk Parity portfolio, but rather it is a mean to achieving the ultimate objective: a portfolio that achieves stable returns in various economic regimes and across different market cycles. To understand how the Risk Parity approach can be effective, it is imperative to understand the varying roles that different asset classes are expected to play in order for the entire portfolio to collectively achieve its objective of consistent, risk-adjusted returns. Many critics seem to forget the big picture and instead focus much of their criticism and skepticism on individual parts of the portfolio construction exercise rather than evaluate how the entire approach is well-suited to achieve the investment objective.

The inclusion of three broad asset classes is crucial for Risk Parity portfolios to target consistent returns over time: they are equities, investment-grade bonds, and commodities. Typically, equities deliver equity risk premium, especially during economic expansions, while high-quality bonds provide interest rate premium and downside protection during economic contractions. Commodities provide inflation hedging when both nominal bonds and equities are negatively affected by rising inflation. Once this general framework is understood, we can address many of the common criticisms associated with Risk Parity. Furthermore, we can ask and address truly important questions regarding Risk Parity portfolios.

Miss the forest for the trees

One common attack of Risk Parity is to argue against the inclusion of certain asset classes based on a perceived expectation of its future performance. For example, Inker[ii] (2011) uses the fact that the yields on US Treasury bonds had fallen to a very low level, and as a result, may no longer offer any return premium in the future. He is by no means alone in expressing this view. We admit that these are valid observations, but they cannot and should not be the only consideration regarding expected asset returns and investment decisions in the asset class. Depending upon the evolution of the current macroeconomic environment there may be a number of outcomes, such as a sustained economic recovery, or a repeat of the Japan experience, to name a few. Asset allocation investors must guard against a deflationary environment in which equities and commodities would perform poorly. On the other hand, if indeed Treasury yields rise due to increases in growth and inflation, equities and commodities in Risk Parity portfolios would likely provide upside participation more than offsetting the losses from bonds. Again, it is balanced exposure to these asset classes which provides the balanced return performance across these different environments.

This diversification argument would boost the case for investing in commodities. Rather ironically, in the same paper, Inker also makes a case against investing in commodities, based on the negative roll yields of many commodities. However, our research[iii] shows that the roll yield is a poor predictor of long-term commodity returns, much poorer in fact than the bond yield as a predictor for future bond returns, as it is not a traditional valuation measure and it is highly susceptible to short-term supply/demand shocks. Given the possibility of rising as well as falling inflation, it is simply **inconsistent or self-contradictory** to shun both Treasury bonds and commodities together.

Another common criticism of Risk Parity is to use simulated Risk Parity portfolios to demonstrate that Risk Parity is no better than the traditional 60/40 portfolios in terms of risk-adjusted returns or Sharpe ratios. Examples of this criticism include the studies of Marlena Lee[iv] (2011) and Denis Chaves at al.[v] (2011). These studies seem to echo the notion “stocks for the long run” since they show risk concentration in equity associated with 60/40 portfolios as not necessarily being an inferior idea for the long run. So are these criticisms right?

We believe the answer is “No.” While these studies take a portfolio view over that of the individual assets, a detailed reading reveals that their portfolios are not exactly Risk Parity. These portfolios are either missing important asset classes or improperly constructed. For example, the analysis by Lee (2011) builds a type of “Risk Parity” portfolio with equities and long-term government bonds. We note that these portfolios are inferior to true Risk Parity portfolios on two fronts. First, the absence of any inflation protection makes them susceptible to inflation shocks. Second, the choice of long-term government bonds exacerbates the inflation shock further since long-duration bonds usually suffer the most in a rising yield environment and they also tend to have the lowest risk-adjusted return across the term structure.

The Chaves at al. (2011) analysis includes all three return premiums in their study. However, they make a simple mistake of applying Risk Parity to unequal numbers of asset classes that represent different risk premiums. Among the nine asset classes selected, five are equity-like, one is commodities, and three are bonds. Equal risk allocation to these nine asset classes would obviously result in a greater allocation to equity-like risk and a lower allocation to interest-rate risk. Furthermore, some of the bond asset classes chosen in the study are credit, which are highly correlated with equity risk. It is no surprise the study finds that their simulated Risk Parity portfolios performed similarly to the traditional 60/40 portfolios. This is because the Risk Parity portfolios they’ve constructed are similar in terms of their risk concentration towards equities. The trees are all there, they are just not planted properly.

Mind the forest

Rather than focusing on individual asset classes, the focus should be on the total portfolio. The forest can be healthy even if a few trees die or decay, but it could be in danger if all of the trees are unhealthy at the same time. Risk Parity invests in different asset classes in order to capture different risk premiums. **The downside risk is when ALL return premiums turn out to be negative.** In other words, during periods when all asset classes underperform the risk-free rate, Risk Parity will have negative risk-adjusted returns – an outcome that fails the objective of Risk Parity portfolios.

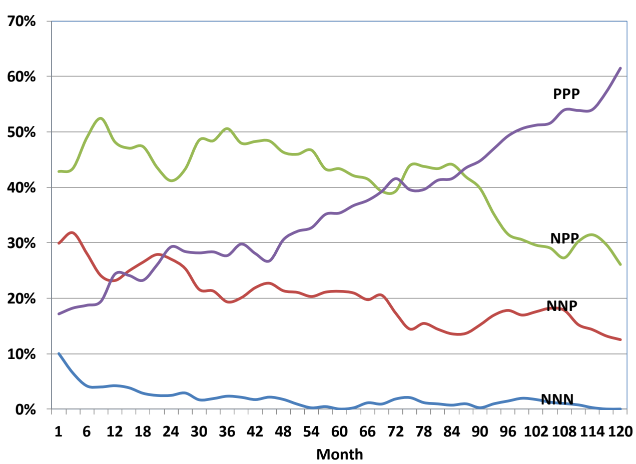
So how likely is this outcome? The answer to this question is important for understanding the strength and potential weakness of the Risk Parity portfolios and for building portfolio protection against this risk.

The key metric in addressing the question is ***the probability that all return premiums of different asset classes are negative over a given time horizon***. We choose three asset classes: equities, sovereign bonds, and commodities; since they represent three distinct return premiums. They are represented by the S&P 500 index, the 10-year US Treasury bond and the GSCI commodity index respectively and the returns are monthly from January 1970 to July 2012. The risk-free return is the three-month US Treasury bill return. This sample of over 40 years covers periods of both high and low inflation, as well as periods of strong and weak economic growth.

Exhibit 1 shows the discrete probabilities of four different outcomes with respect to the signs of three return premiums over different horizons ranging from 1 month to 120 months, or 10 years. The label NNN denotes three negative return premiums over the risk-free rate, NNP denotes two negative and one positive, and so on.

Several features of the graph are worth noting. First, the probability of triple misses, or three negative premiums (NNN), is consistently the lowest among the four outcomes. It starts at roughly 10% on a monthly basis and declines steadily as the horizon lengthens. It is about 4% over 12 months and 2% over 36 months. The probability stays at a very low level beyond this point, but it doesn't vanish completely until the horizon reaches beyond 10 years.

Exhibit 1 Probabilities of four distinct outcomes for the excess returns of equities, bonds, and commodities



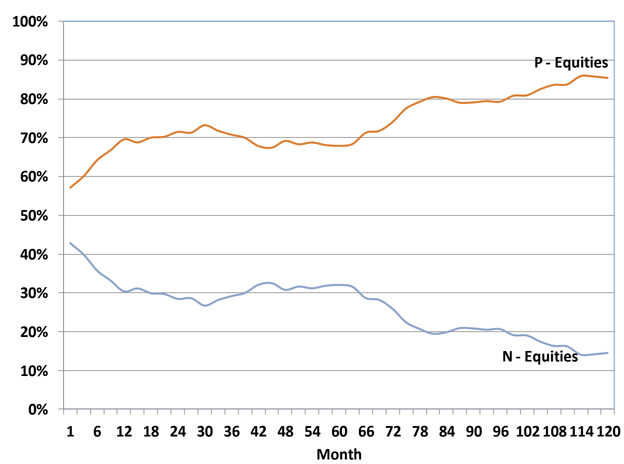
For illustrative purposes only. Source: PanAgora

Second, the probability of triple hits, or three positive premiums (PPP), increases almost monotonically from about 20% to 60% when the horizon is lengthened to 10 years. This 40% increase comes from the decrease in the probabilities of NNP and NPP.

Lastly, another notable observation is that the probability of at least one negative return premium, which is equal to the sum of the probabilities of NNN, NNP and NPP[vi], is always very high. It is roughly 70% for a three-year horizon and 50% for an eight-year horizon. This not only highlights the non-diversification risk of a single asset, but also shows how easy it is in hindsight to identify individual assets that might have underperformed for a long period of time.

Exhibit 1 reinforces the case for Risk Parity as risk premiums of these assets are positive over the long-term, and their diversification benefits also increase over the long-term with increasing upside probability in PPP and decreasing downside risk in NNN. These statistics, focusing on discrete states of return premiums, are appropriate for Risk Parity portfolios, which balance the risk and return contributions from different asset classes. This parity feature allows us to treat a hit (P) and a miss (N) equally regardless of asset classes.

Exhibit 2 Probabilities of positive and negative equity excess return over different horizons



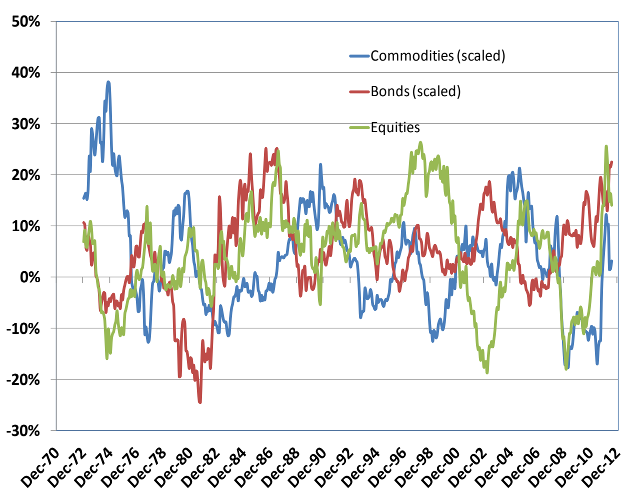
For illustrative purposes only. Source: PanAgora

On the other hand, for a 60/40 portfolio, because of its risk concentration in equities, a hit (P) or a miss (N) in equities is far more important than a hit (P) or miss (N) in bonds. Therefore, the downside risk of a 60/40 portfolio mirrors the downside risk of equities. Exhibit 2 shows the discrete probabilities of experiencing positive and negative equity return premiums. Even though the probability of negative equity excess return declines as the horizon is lengthened, it always stays above 10%, which is much higher than the probability of NNN in Exhibit 1. In other words, the downside risk of three return sources is much less than the downside risk of one.

When and what do we worry about?

Even though the probability of three simultaneous negative excess returns diminishes over a long horizon, those outcomes did occur in our sample period. When they happen, it is not necessarily the case that Risk Parity portfolios would have absolute negative returns, but it does mean **that they, along with all other asset allocation portfolios, would underperform the risk-free asset**. Those cases in which investors received negative rewards for taking any risk deserve a closer examination.

Exhibit 3 The rolling 36-month annualized excess returns of three asset classes



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We choose a horizon of 36 months over which to analyze the time series of excess returns from the three asset classes. Exhibit 3 plots the rolling 3-year annualized excess returns of the S&P 500 index, the 10-year US Treasury bonds, and the GSCI index. To equalize the risk of the three asset classes, we scale the returns of bonds and commodities such that their return volatilities match that of equities. Before we discuss their simultaneously negative excess returns, we make a few remarks about the individual return series.

First, after rescaling, the bond return premium shows similar variability to equities. Since the early 80s, its 3-year excess returns have been quite strong and it was rarely significantly negative, thanks to declining inflation and yields. But it is worth noting that even in the 70s when inflation rose sharply, there are periods when bonds delivered positive excess returns.

Second, the return series of equity premium is volatile, but it predictably follows the business cycles, rising during expansion regimes and falling sharply during recessions. While the returns of equities and bonds more or less offset each other since the year 2000, they are more in-sync prior to 2000. This changing relationship is a reflection of changes in real growth and inflation.

Lastly, commodity returns have experienced more sharp drawdowns. Commodities also had the biggest spike during the first oil shock from 1973 to 1974. While they have behaved in a similar fashion to equities since 2002, commodities were a good diversifier to both nominal bonds and equities prior to 2002.

A visual inspection of Exhibit 3 shows that there are more negative asset class returns during the 70s and early 80s. To illustrate this more clearly, we first convert the returns for the three asset classes in Exhibit 3 to their signs, +1 for positive and -1 for negative. Next we add the three signs together to get an aggregated time series, which takes on four numerical values: 3 for three positive returns (PPP), 1 for two positives and one negative (NPP), -1 for two negatives and one positive (NNP), and -3 for three negatives (NNN). The blue line (with left axis) in Exhibit 4 shows this series[vii].

Exhibit 4 The blue stepwise line depicts the discrete states of positive and negative return premiums of the three asset classes with 3-year rolling window. The two curves are 3-year rolling annualized cash return and annualized inflation rate with right axis.

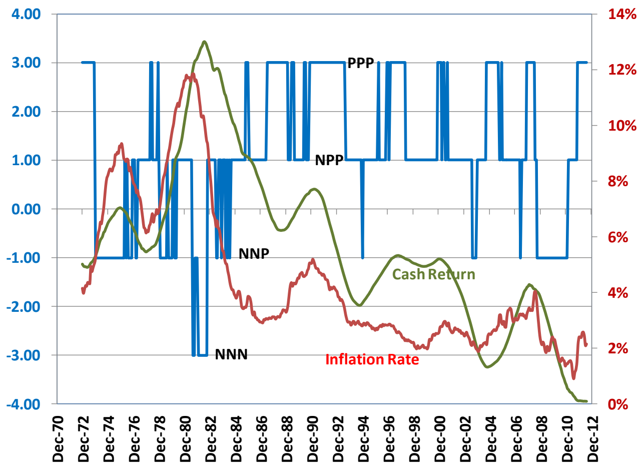

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Exhibit 4 makes it apparent that the cases of three negatives as well as most of the cases with two negatives occurred during the 70s and the early 80s.

The fundamental difference between those early periods and the period since then is the level of inflation. In Exhibit 4, we also plot the rolling three-year annualized rate of inflation and annualized cash returns (with right axis). The inflation rate rose from near 4% to 9% during the first oil shock, and then to 12% during the second oil shock. These two spikes in inflation devastated both nominal bonds and equities while commodities provided inflation hedging. However, this hedging was not guaranteed. When commodities failed to provide positive excess returns, the result was the triple miss, where all three asset classes were generating negative returns. In summary, the culprit has been inflation shocks, which poses a real threat to all asset allocation portfolios including Risk Parity.

Defense against future inflation shocks

How serious is this risk today? First, inflation is quite low in the aftermath of the global financial crisis and growth remains weak despite low interest rates. The period of high inflation, should it come, is likely some years away. Second, to a large extent, Risk Parity portfolios have many inflation hedges built-in by including real assets, such as commodities and inflation-linked bonds, which a 60/40 portfolio typically lacks.

On the other hand, it is never too early to prepare. While Risk Parity's inflation protection is adequate during periods of moderate inflation, it might not be sufficient for periods of sharp increases in inflation. So how do we shore up inflation defenses under those scenarios? While a full analysis of various approaches is beyond the scope of the present paper, we think the following list can be useful.

Dynamic risk allocation

When inflation is persistently high, the risk-adjusted returns of nominal bonds and equities would likely be lower than that of inflation-linked bonds and commodities. A tactical shift in risk allocation can dynamically allocate more risk to real assets at the expense of traditional assets, such as equities and nominal bonds. Therefore, dynamic risk allocation can improve the overall risk-adjusted return of the total portfolio. Our research has shown the benefit of dynamic risk allocation would have been quite large in the 70s[viii].

Deleveraging

When all return premiums are negative, any long-only exposure to these asset classes will result in lower portfolio returns. On the other hand, cash returns are often quite high during these periods, due to rising short-term interests, illustrated by Exhibit 4. As a result, another form of inflation protection would be reducing the portfolio's risk exposures such that the total portfolio return becomes more dependent on the cash return, and less dependent on risk premiums. The deleveraging can take place due to rising volatilities and correlations of asset returns. It can also be an active decision based on a systematic process.

Additional inflation exposures

If desired, we could also use additional asset classes for inflation protection and increase the allocation to inflation-sensitive sectors within individual asset classes. For example, an equity portfolio with a higher allocation to commodity-related stocks would tend to perform better in a rising inflation environment than a traditional equity portfolio. In a rising inflation environment, a nominal bond portfolio with a greater allocation to the short end of the term structure might outperform a nominal bond portfolio heavily weighted to the long end of the term structure.

Conclusion

This research note addresses what we believe is the inaccurate basis of most criticisms aimed at Risk Parity portfolios. Such criticisms are either myopically focus on individual asset classes thus missing the point of portfolio diversification, or they are based on improper interpretation and implementation of Risk Parity.

We believe, when constructed properly, the potential weakness of Risk Parity does not lie in the performance of individual assets, but rather when all assets have negative return premiums. We conduct a historical examination of three asset classes since 1970 and show that this scenario has very low probability of occurrence and would be most likely during periods with persistently high inflation.

Our research shows there are a number of ways to provide additional inflation protection for Risk Parity portfolios. The first is dynamic risk allocation, which can tilt portfolios more towards real assets. The second is deleveraging to cut portfolio exposures or portfolio risk. Finally another approach is to build customized exposures to individual asset classes, such that they would be more sensitive to inflation than normal.

Index Descriptions

The S&P 500 Index is an unmanaged list of common stocks that is frequently used as a general measure of U.S. stock market performance.

The S&P GSCI® is a composite index of commodity sector returns representing an unleveraged, long-only investment in commodity futures that is broadly diversified across the spectrum of commodities.

realized. No representation or warranty is made as to the reasonableness of the assumptions made or that all assumptions made in the discussion herein have been stated or fully considered. The discussion of hypothetical scenarios have many inherent limitations and may not reflect the impact that material economic and market factors may have had on the decision-making process if client funds are actually managed in the manner shown.

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[i] The author thanks Bryan Belton and Michael Campbell for their helpful comments.

[ii] Inker, Ben, “The Dangers of Risk Parity”, Journal of Investing, Vol. 20, No. 1, Spring 2011.

[iii] We demonstrate that roll yield is not a traditional valuation measure such as bond yield or dividend yield and it is not a good predictor of future commodity returns (Investment Insight, “Roll Yield and Commodity Return”, PanAgora Asset Management, November 2011.)

[iv] Lee I. Marlena, “Eight Decades of Risk Parity”, Dimensional Fund Advisors, August 2011.

[v] Chaves, Denis, Jason Hsu, Feifei Li, and Omid Shakernia, “Risk Parity Portfolio vs. Other Asset Allocation Heuistic Portfolios”, Journal of Investing, Vol. 20, No. 1, Spring 2011.

[vi] Or equivalently it is one minus the probability of PPP.

[vii] If we compute the frequencies of the four states over the entire period, we arrive at the probabilities of NNN, NNP, NPP, and PPP for the 36 month horizon, which are plotted in Exhibit 1 as four points along the four different curves.

[viii] Qian, Edward, “Risk Parity and Inflation”, 2007, PanAgora research paper