



Risk Parity Portfolios™: The Next Generation

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Summary

In this paper, I will review the original research insight and rationale for PanAgora Risk Parity Portfolios and then describe how we have further extended the Risk Parity approach to global equity, bond, and commodity portfolios in order to provide multiple layers of portfolio diversification and superior long-term returns.

Risk Parity Portfolios — the first generation

When I wrote the research paper titled “Risk Parity Portfolios: Efficient Portfolio through True Diversification” in 2005,¹ I stated that traditional 60/40 or so-called balanced portfolios do not offer investors true diversification because the 60% stock allocation actually accounts for over 95% of the portfolio risk (as defined by variance of returns). In a sense, 60/40 portfolios put almost all the “eggs” in one basket. When (not if) the stock market has a severe downturn, 60/40 portfolios would also suffer tremendous losses. I arrived at this conclusion, based not so much on what we have observed of financial markets over time, but rather on an insight that a direct relationship exists between loss contribution to a portfolio from its underlying components, and their risk contribution counterparts. This link is theoretically proven and empirically verified.²

The original Risk Parity paper further proposes that one way to construct truly diversified portfolios with significant downside protection is to balance the risk contribution, hence loss contribution, from high-risk assets and low-risk assets (mostly government bonds). The research effort led to the creation of the PanAgora Risk Parity Portfolio, which comprises global stocks and global government bonds, along with inflation protection via commodities and TIPS. The explicit goal of this portfolio is to achieve balanced risk between stocks and bonds, such that the portfolio can be protected from severe losses of either stocks or bonds.

The dramatic events that have taken place in the world financial markets in the past eighteen months have validated the importance of balanced risk allocation between stocks and government bonds. Furthermore, they show that a mere reallocation among risky assets, for instance moving into private equity, real estate, high-yield bonds, hedge funds, etc., by reducing traditional equity stake, does not provide true diversification as the correlations among the risky assets rise significantly during financial stress. The fact that very few people saw the financial crisis coming once again reveals the shortcomings of traditional strategic asset allocation approaches that rely heavily on long-term return forecasting and mean-variance optimization.

¹ See previous publication: “Risk Parity Portfolios: Efficient Portfolios through True Diversification.” PanAgora Asset Management, September 2005.

² See Edward Qian, 2006, “On the Financial Interpretation of Risk Contribution: Risk Budgets Do Add Up.” *Journal of Investment Management*, Vol. 4, No. 4.

Today we find ourselves in the midst of the worst global recession in the past 75 years. Despite unprecedented government-sponsored bailouts and monetary and fiscal stimulus, the prospects of global economic growth and inflation still appear highly uncertain. It remains a daunting task to forecast strategic returns of various asset classes with a high degree of confidence.

For long-term investors searching for truly diversified asset allocation portfolios, the Risk Parity approach is just as important as always.

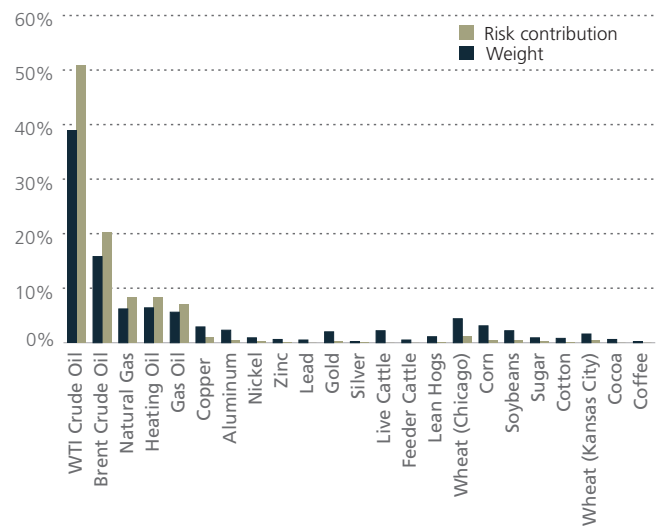
Global indices and their risk contribution

Underneath the Risk Parity Portfolios, there are exposures to global equity, global bonds, and commodities. Our most recent research demonstrates that the Risk Parity methodology is also a better way to construct more efficient portfolios of these underlying assets. This should not be surprising to anyone, because most indices, whether they are based on market capitalization or output production, amount to capital allocation. A closer examination reveals that they too have skewed risk contribution and lack true diversification.

1. S&P GSCI Commodity Index

The S&P GSCI Commodity Index is an example of an unbalanced index with skewed risk contribution. As shown in Figure 1, the index has over 70% of its weight in the energy sector, which in turn comprises 95% of the risk, while the remaining four sectors account for just 5% the total risk. The higher percentage of risk contribution from the energy sector is due to the fact that energy markets are more volatile than other commodity markets. The situation is entirely similar to a 60/40 portfolio that has 95% of its risk in equity. As a result, the GSCI Index return depends largely on the fate of the energy markets, while other low-risk and non-cyclical commodities, such as precious metals and agriculture, provide little diversification benefits.

Figure 1: GSCI weight and risk contribution



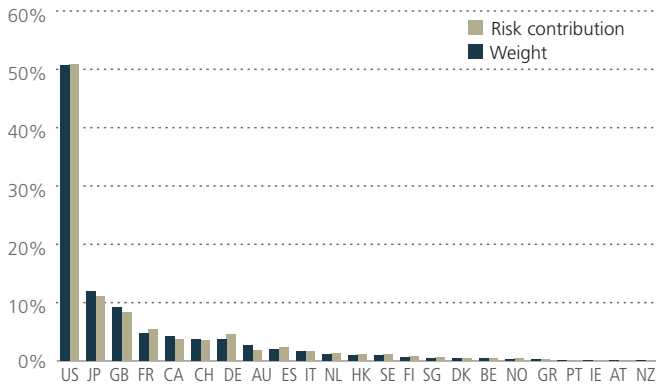
Source: PanAgora. For illustrative purposes only.

2. MSCI World Equity Index

Viewed through the lens of risk contribution, the capitalization-weighted global indices are also deficient. Figure 2 shows the MSCI World country weights and their risk contribution. As expected, the United States accounts for roughly 50% of the weight and 50% of the risk while Japan contributes the most within the non-U.S. universe. On a regional basis, Europe contributes the majority of risk within the non-U.S. universe. It is noted that, even though individual risk weights and country weights of index constituents are somewhat close in value, they are not the same. This is due to differences in risks of individual countries and correlations among countries.

Figure 2 clearly paints a picture of an underdiversified portfolio with concentrated risk in a few countries. Because of this, the index's risk and return are driven by those few countries, and over time it typically underperforms naïve alternatives such as an equally weighted portfolio.

Figure 2: MSCI World country weight and risk contribution



Source: PanAgora. For illustrative purposes only.

Risk Parity Portfolios — the next generation

While debates about the efficiency of capitalization-weighted benchmarks sound academic, the fact that these benchmarks are underdiversified with concentrated risk contribution has serious practical consequences for investors, namely low return and high risk, or poor Sharpe ratio. With this in mind, using the Risk Parity methodology as an analytic framework, we have extended our Risk Parity Portfolios to a broad range of components in equity, bonds, and commodities.

We follow the same consistent approach to construct this next generation of Risk Parity Portfolios. First, we select a number of countries or commodities based on economic and liquidity criteria. Next, we determine dynamic risk allocation by combining Risk Parity targets and proprietary models that forecast changes in relative Sharpe ratios of underlying assets. This approach combines long-term equilibrium in risk-adjusted returns of various assets, and intermediate-term market inefficiency brought out by economic change and investors' behavior bias. We then derive capital allocation based on the risk budgets, total risk level, and estimated risk metrics. The final outcome of this process is a suite of Risk Parity Portfolios that allocate risk budgets efficiently and reflect dynamic changes in volatilities and correlations in the market place.

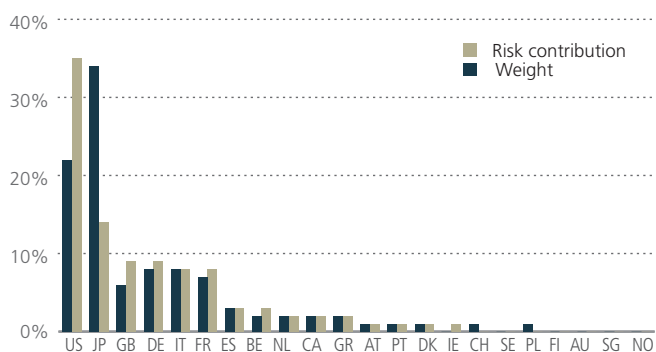
It is worth pointing out that Risk Parity methodology differs from traditional minimum variance portfolios in several important ways. First, even though both approaches construct portfolios using risk inputs, Risk Parity emphasizes risk diversification while minimum variance focuses on risk reduction on a total portfolio level. Second, Risk Parity uses risk budgeting for portfolio construction while minimum variance still follows an optimizer, which is much more sensitive to volatility and correlation inputs. As a result, minimum variance portfolios might have lower levels of overall risk than Risk Parity Portfolios, but they are always much more concentrated, due to the nature of optimization. This can result in higher portfolio turnover and in higher return drawdown for minimum variance portfolios.

Our backtest results show that in all cases without exception, the Risk Parity Portfolios provide better Sharpe ratios with higher long-term returns relative to the traditional benchmarks with similar or lower risk. On an annual basis, Risk Parity

3. Citigroup World Government Bond Index

Figure 3 shows country weights and risk contribution in the Citigroup World Government Bond Index sorted by risk contribution. Two features are worth highlighting. First, similar to the commodity and equity indices previously discussed, the bond index is also dominated by a small number of countries including the United States, Japan, Great Britain, Germany, Italy, and France. Second, although Japan has the largest weight in the index, it ranks behind the United States, which has the second-highest weight, in terms of risk contribution. This reflects the fact that Japanese government bonds have lower volatility than U.S. government bonds. This is yet another example in which capital allocation and risk allocation show significant difference because of disparity in volatility. We must take this into account when we construct a more efficient portfolio for global government bonds.

Figure 3: WGBI country weight and risk contribution



Source: PanAgora. For illustrative purposes only.

Commodity Portfolio outperformed the GSCI Index by over 700 basis points, Risk Parity Equity Portfolio outperformed the MSCI World Index by 250 basis points, and Risk Parity Bond Portfolio outperformed the WBGI Index by 40 basis points.

When we use Risk Parity Equity/Bond/Commodity Portfolios as components of Risk Parity Asset Allocation Portfolios, the total portfolios have multiple levels of diversification and higher long-term returns. These portfolios are also suitable for investors looking for efficient exposure to those specific markets. But why do we stop here? Why not Risk Parity stock and bond portfolios for individual countries or sectors? The benefit is real because the principle of true diversification is universal. In the next article, I will write about evolving another generation of Risk Parity Portfolios.

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Past performance is not a guarantee of future results. As with any investment, there is a potential for profit as well as the possibility of loss.

Hypothetical performance results have many inherent limitations, some of which are described below. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently achieved by any particular investment program. One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or to adhere to a particular investment program in spite of trading losses are material points which can also adversely affect actual trading results. There are numerous other factors related to the markets in general or to the implementation of any specific investment program that cannot be fully accounted for in the preparation of hypothetical performance results, all of which can adversely affect actual trading results.

The information presented is based upon the hypothetical assumptions discussed in this piece. Certain of the 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.

International investing involves certain risks, such as currency fluctuations, economic instability, and political developments. Additional risks may be associated with emerging-market securities, including illiquidity and volatility. Active currency management, like any other investment strategy, involves risk, including market risk and event risk, and the risk of loss of principal amount invested. The use of alpha overlay strategies consists of hedging, which may in certain circumstances cause the value of a portfolio to appreciate or depreciate at a greater rate than if such techniques were not used, which in turn could result in significant losses. Derivative instruments, may at times be illiquid, be subject to wide swings in prices and difficult to value accurately, and be subject to default by the issuer. Strategies that use leverage extensively to gain exposure to various markets may not be suitable for all investors. Any use of leverage exposes the strategy to risk of loss. In some cases, the risk may be substantial.

Benchmark descriptions

The unmanaged indices described below do not reflect fees and expenses and are not available for direct investment.

The S&P GSCI (formerly Goldman Sachs Commodity Index[®]) is a world production-weighted commodity index composed of liquid, exchange-traded futures contracts.

The Morgan Stanley Capital International (MSCI) World Equity Index is an unmanaged list of securities from developed and emerging markets, with all values expressed in U.S. dollars.

The Citigroup World Government Bond Index (formerly Salomon Smith Barney World Government Bond Index (WGBI)) is a market-capitalization-weighted benchmark that tracks the performance of the most liquid government bond markets including Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

Further information on the 60/40 Portfolio:

The Risk Parity portfolio invests in nine asset classes: U.S. large-cap equity, U.S. small-cap equity, international equity, emerging-market equity, U.S. Treasury bonds, international government bonds, U.S. corporate bonds, TIPS, and commodities.

The information presented is based upon the following hypothetical assumptions: Risk Parity Foundation and Risk Parity Dynamic portfolios were constructed using a hypothetical combination of nine index returns based on the following indices: GSCI Commodity Index (Commodities), Barclays Capital Government Bond Index (U.S. Gov.), Barclays Capital TIPS Index (TIPS), iShares iBoxx Investment Grade Corporate Bond Fund (Corporate Credit), Salomon Smith Barney World Government Bond Index ex-U.S. (Int'l Gov.), S&P 500 (U.S. Large Cap), Russell 2000 (U.S. Small Cap), MSCI Emerging Markets (EM Stocks), and MSCI EAFE (Int'l Stocks). The Risk Parity Foundation portfolio monthly rebalance targets constant risk allocation from stocks, bonds, and commodities. The Risk Parity Dynamic portfolio rebalances monthly, and the risk allocation to the nine asset classes differs based on the forecasted Sharpe Ratios of each asset class.

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