

Risk Parity Optimality

Overview

A risk-parity portfolio will beat actively or passively managed portfolios more than 50% of the time, according to this research. The authors explain how a risk-parity asset allocation strategy—which ignores expected returns and correlations—actually works, and under what conditions. They present their theoretical framework, explain their reasoning and provide empirical support using the returns of stocks and bonds.

Practical Applications

- **It outperforms.** A risk-parity portfolio will outperform an equally weighted portfolio, a passive market portfolio or any other market portfolio more than 50% of the time.
- **It requires leverage.** Risk parity works only if the institutional investor can leverage up to improve overall portfolio returns.
- **It is easier to structure.** A risk-parity strategy requires less data and less-sophisticated modeling than other portfolio construction methods.

Practical Applications Report

Risk parity is a popular portfolio allocation strategy that weighs assets inversely proportionally to their risk. But the reason it works was a bit of a mystery before this paper, says **Philip Maymin**, Associate Professor of Finance and Analytics at the **University of Bridgeport's Ernest C. Trefz School of Business**. "Risk parity works. Many funds offer it, and many portfolio managers are talking about it. But no one really understands *why* it works!"

Typically, investment information about asset selection includes the manager's view on expected returns, risk and correlation. But risk parity completely ignores both expected returns and correlations. "You only use the asset volatilities," Maymin points out. Instead of an equal-dollar weighting that allocates to assets based on their size, or an equal weighting that allocates 1-over- n to each of n assets, risk parity allocates to assets based on their risk levels, he explains. If one asset (fixed income) is less risky, more of the portfolio is allocated to it; if another asset (equity) is more risky, less of the portfolio is allocated to it. But *why* does this risk parity approach work?

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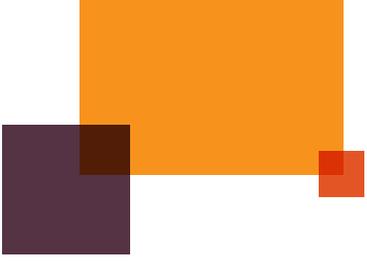
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Why does risk parity work?

It's no longer
a **MYSTERY**.



*Risk parity outperforms
any other market portfolio
more than **50%** of the
time.*



Key Definitions

Risk parity

A portfolio allocation process that invests in each of the component assets in such a way that the individual risks of each component are equal.

—Philip Maymin

Sharpe ratio

The Sharpe ratio uses standard deviation to measure a fund's risk-adjusted returns. The higher a fund's Sharpe ratio, the better its returns have been relative to the risk it has taken on. Because it uses standard deviation, the Sharpe ratio can be used to compare risk-adjusted returns across all fund categories. It was developed by Nobel laureate William F. Sharpe.

—www.morningstar.com

Tangency portfolio

In the Capital Asset Pricing Model (CAPM), the portfolio that provides the optimal combination of risky assets with risk-free assets. It is measured on the Capital Market Line (CML), which runs tangent to the efficient frontier, and provides the maximum return for each level of risk (see also, Sharpe ratio).

“It was my father's insight that's at the heart of the paper. He proved mathematically that risk parity is the best possible portfolio allocation method.”

—Philip Maymin

That's the question that Maymin and his co-authors seek to answer in this research. His co-authors are **Gregg Fisher**, Chief Investment Officer of **Gerstein Fisher**, and **Zakhar G. Maymin**, formerly head of research at Gerstein Fisher's research center and member of its investment strategy group. Zakhar is Philip's father, and all three co-authors are longtime collaborators. Their article, *Risk Parity Optimality*, is in *The Journal of Portfolio Management's* Winter 2015 issue.

IT DOES OUTPERFORM

The authors lay out their mathematical validation for the risk-parity approach by formulating the exact conditions of the uncertainties of asset volatilities and how they can perform under different conditions.

“It was my father's (Zakhar's) insight that's at the heart of the paper. He proved mathematically that risk parity is the best possible portfolio allocation method,” Maymin says. In effect, their research shows that there is a more than 50% probability that risk-parity portfolios will outperform other portfolios under specific conditions.

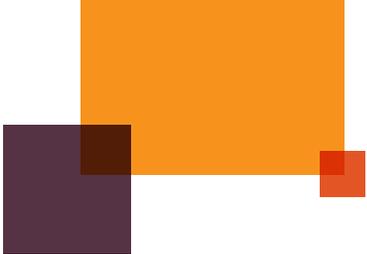
Two different market portfolios (technically, tangency portfolios) exist, Maymin says. The tangency portfolio provides the optimal combination of risk-free and risky assets, in order to maximize returns for each level of risk, under the Capital Asset Pricing Model (CAPM). The first type is the ex ante or “prior” tangency portfolio, which is based on estimations of expected returns going forward, Maymin says. The second is the ex post or “after” tangency portfolio, which is based on actual returns—if one only knew them ahead of time. But since no one can know the future, the difference between the ex ante and the ex post portfolio is actually very large, he notes.

The key insight of this research is to show that whereas the risk-parity portfolio will never equal the ex post tangency portfolio—which is, by definition, the best—more than 50% of the time it will outperform the ex ante tangency portfolio, the equally weighted portfolio, the equal-dollar portfolio and any other portfolio, says Maymin. As part of their analysis, the authors integrate aspects of game theory. They show that the risk-parity portfolio does better under worse conditions than any other strategy.

SUCCESS REQUIRES LEVERAGE

Allocating the assets by risk level also isn't the whole story, Maymin adds. By its nature, the risk-parity portfolio tends to be more invested in bonds and less in stocks. “It's very low risk, but also very low return,” he says. So the investor needs to leverage up in order to make money.

For instance, Maymin says, “You may get 3% return per year (without leverage) in a risk-parity portfolio. But if you leverage it up five times, then you make 15% per year. “You have to leverage up risk parity to make it work.” The approach is useful only for investors who can leverage, so as to make the strategy viable for the long term, he adds.



The approach is useful only for investors who can LEVERAGE!

“If you’re already doing risk parity, this gives you more comfort about why it works. If you were wondering how exactly it works, this gives you a way to better understand it.”

—Philip Maymin

IT’S EASIER

Forming risk-parity portfolios does not require as much data and as many sophisticated tools as forming other portfolios, such as the tangency portfolio embraced by standard portfolio theory, say the authors.

Maymin notes that their research also settles the broader question of whether risk parity is just a clever heuristic approach as opposed to the traditional financial-optimization-based approach to portfolio management. Typically, researchers have tended to contrast heuristic approaches as “intelligent guesswork” in contrast to the complex algorithms of structured approaches.

This research shows that risk parity is a “fast and frugal” heuristic approach—one that does not need a lot of data—that tends to outperform both the more complex mean-variance approaches or the more simple equally-weighted approaches, Maymin says.

The authors do recognize in their research that risk parity does not always outperform. But by outlining the theoretical conditions under which the risk parity portfolio can outperform, fund managers can better understand how and why it works, Maymin says, and they can apply it accordingly. Depending on their views on the underlying conditions, portfolio managers can decide when to tilt toward or away from risk parity, he notes. The full theoretical conditions are detailed in their JPM article.

Their research results have garnered positive reaction from investment managers, he adds. “If you’re already doing risk parity, this gives you more comfort about why it works. If you were wondering how exactly it works, this gives you a way to better understand it.”

Maymin has worked with his father Zakhar “since I was born,” he laughs, including on a hedge fund. They have co-authored several papers, including an earlier one on risk parity, *Maimonides Risk Parity*. The results from the current research have been particularly interesting to co-author Fisher, a colleague and friend of the Maymins for many years. Fisher has been continually exploring ways to extend institutional-level investment management strategies to the firm’s retail clients, Maymin says.

Currently, Philip’s research areas include behavioral finance, derivatives, sports analytics and algorithmic finance. When not working, he enjoys spending time with his children. Zakhar currently concentrates on developing foreign exchange and futures trading strategies, and he is working on estimating future performance of a trading strategy based on its complexity. He is also doing some writing and is developing training software for chess players.

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Gregg founded investment management firm **Gerstein Fisher** in 1993. Today, as Chief Investment Officer, Gregg is responsible for the management and oversight of Gerstein Fisher's investment process, including portfolio management, trading, risk control and investment strategy development. He also spearheads Gerstein Fisher's many research projects on areas of study that have included momentum and valuation models and tax-efficient investing.

Gregg is widely quoted in the financial press, including *The Wall Street Journal*, *The New York Times*, the *Financial Times*, *Fortune* and *Forbes*. His blog, *Invest With Reason*, appears on *Forbes.com*.

A CFA charterholder, Gregg is a member of the **CFA Institute**, the **New York Society of Security Analysts (NYSSA)** and the **Institute for Quantitative Research in Finance (the Q Group)**. Gregg holds a degree in finance from the State University of New York at Buffalo.



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Philip is Associate Professor of Finance and Analytics at the **University of Bridgeport's Ernest C. Trefz School of Business**. He is the Founding Managing Editor of *Algorithmic Finance* and the co-founder and co-editor-in-chief of the *Journal of Sports Analytics*. He has also been an analytics consultant with several NBA teams and is the Chief Analytics Officer for **Vantage Sports**.

Philip has been a portfolio manager at Long-Term Capital Management, Ellington Management Group and his own hedge fund, Maymin Capital Management. His research on behavioral and algorithmic finance has appeared in *Quantitative Finance*, *North American Journal of Economics and Finance*, *The Journal of Portfolio Management*, *The Journal of Wealth Management*, *Journal of Applied Finance*, and *Journal of Investment Management*, among others, and his textbook, *Financial Hacking*, was recently published by *World Scientific*.

He is an award-winning journalist and the author of *Yankee Wake Up*, *Free Your Inner Yankee* and *Yankee Go Home*. He was a finalist for the 2010 **Bastiat Prize for Journalism**. Philip's popular writings have been published in dozens of media outlets.

Philip holds a PhD in finance from the University of Chicago, an MS in applied mathematics from Harvard University and a BSc in Computer Science from Harvard University. He also holds a JD and is an attorney-at-law admitted to practice in California.



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Zak is a member of the investment strategy group at **Gerstein Fisher** and was formerly head of research at the firm's research center. His background includes both academic and practitioner experience. He has worked at several companies, including Susquehanna, Sakura and Gerstein Fisher, developing risk systems, algorithmic trading and pricing derivatives. He has also been a hedge fund portfolio manager at Ellington and later founded, with his son Philip, their own hedge fund.

Zak was a professor of mathematics and statistics at Northeastern University and an adjunct professor of finance and risk engineering at NYU. He holds a PhD in mathematics/statistics from MIT. He is the author of more than a dozen academic papers in probability and statistics as well as finance, including applications of portfolio management, risk parity, optimal strategy construction and risk management. He is also the author of *Publicani* and *Truth: Ethics for Your Child* and was a New York State chess co-champion.

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