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"PORTFOLIO REBALANCING AND COMMODITIES: THE WHOLE IS GREATER THAN THE SUM OF ITS PARTS"

ROBERT GREER, SCHOLAR IN RESIDENCE,
J.P. MORGAN CENTER FOR COMMODITIES,
UNIVERSITY OF COLORADO DENVER BUSINESS SCHOOL

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Portfolio Rebalancing and Commodities: The Whole is Greater Than the Sum of the Parts

Robert Greer

Scholar in Residence, J.P. Morgan Center for Commodities, University of Colorado Denver Business School; and Former Executive Vice President and Real Return Product Manager, PIMCO



Presentation by Robert Greer, Scholar in Residence at the J.P. Morgan Center for Commodities (JPMCC) at the University of Colorado Denver Business School, at the JPMCC's Research Council meeting in the Center's CoBank Lecture Hall on December 4, 2015.

Harry Markowitz is credited with saying that diversification is the closest thing an investor can get to a free lunch. In Markowitz (1952), he also suggested that a portfolio should periodically rebalance to target weights. These two concepts of diversification and rebalancing come together in the idea that rebalancing the investments within a diversified portfolio can provide incremental returns: the purported “free lunch.” These concepts are especially relevant when investing in commodities, which in fact are a collection of individual assets that can be rebalanced. Individual commodity futures prices are driven partially by changes in supply expectations, which are different for different commodities.



Portfolio Rebalancing and Commodities

Therefore, a broad-based commodity index represents a portfolio of assets that typically have a low correlation to each other.

Rebalancing a portfolio ultimately means that an investor will sell what goes up and buy what goes down to maintain a desired set of risk-factor exposures. Consider the possibility of not rebalancing, as applied to stocks and bonds. From January 1976 through December 2013, a non-rebalanced portfolio that initially was allocated 60%/40% to stocks/bonds (as represented by the S&P 500/Barclays U.S. Aggregate Total Return Index) would have evolved to a portfolio that was 80% stocks due to the outperformance of equities over that time. Its set of risk factors would be far different from those of the 60/40 portfolio that the investor initially desired.

Maintaining a target allocation mix over time requires rebalancing. In the next section I discuss the incremental return that one can earn from rebalancing. From real-world examples, I show that this incremental return is substantial enough that investors should incorporate it in their forward-looking return projections; that is, portfolios should be prepared for a bite of Markowitz's "free lunch"!

Calculating the Rebalancing Return

In 1982, Robert Fernholz and Brian Shay (with an assist from Markowitz himself) developed a formula to calculate this incremental rebalancing return. In Fernholz and Shay (1982), they relied on the volatility of individual assets in a portfolio, their individual weights, and their sets of covariances (i.e., the extent to which the assets move or change together). Decades later, Scott Willenbrock approached the same issue, but also addressed the contribution of each individual asset to the portfolio's overall diversification return using the same inputs of volatility, weights and covariances, in Willenbrock (2011).

My former colleagues at PIMCO and I applied these theories in the real world of investing. To do so, we first specified components and weights of a portfolio, and then calculated the return over a multi-period timeframe during which we rebalanced. We then compared the realized returns of that rebalanced portfolio with the weighted average geometric return of the individual components. The difference between these two is the rebalancing return, or as Willenbrock calls it, the "diversification return" – or as Markowitz calls it, the "free lunch."

We next compared this empirical calculation of rebalancing return with the theoretical rebalancing return, as specified by Willenbrock and by Fernholz and Shay. First, we examined a portfolio that was weighted 25% stocks, 25% bonds, 25% real estate and 25% commodities (represented by the S&P 500, Barclays U.S. Aggregate TR Index, NCREIF Property Index TR and S&P GSCI Index, respectively).

With monthly rebalancing from December 31st, 1979 through December 31st 2013, the empirical rebalancing return was 0.93%, which is within rounding error of the theoretical rebalancing return of 0.94%. We calculated the empirical rebalancing return as described above: it is the actual portfolio return minus the weighted average of returns of the individual components. So in determining a forward-looking estimate of portfolio returns, one could add this rebalancing return to the weighted

average of the capital market assumptions of the individual portfolio constituents, as long as one can assume the same volatilities and covariances in the future.

Calculating the Rebalancing Return for Commodities

Because commodities as a separate asset class represent a portfolio of disparate (and often uncorrelated) individual assets, we applied this same analysis to just a commodity index, which may, in turn, be part of a portfolio. To determine weights, we calculated the average weight of each component of the Bloomberg Commodity Index (BCOM) based on data at the end of January of each year since 1992. (For simplicity we combined the weights of the two wheat contracts into a single index component; likewise with crude oil.)

Using this framework, the theoretical rebalancing return as determined by the formula was 3.09%; the empirical rebalancing return was 3.08%, again within rounding error of the theoretical return. The magnitude of this return is very meaningful in the estimation of capital-market assumptions to commodities as an asset class. Due to the effect of the rebalancing return, the investor could even assume that each individual commodity in an index had a zero return over time, but, if the index rebalanced, the asset class could still have a positive return. While the S&P GSCI, another commodity performance benchmark, does not rebalance as prices change, the BCOM rebalances annually (at the same time that it reweights).

As another example, the Credit Suisse Commodity Benchmark (CSCB) rebalances monthly with annual reweighting. And in an informative exercise, I once used the Fernholz and Shay formula to calculate the theoretical year-by-year rebalancing return of the JPMorgan Commodity Futures Index (JPMCFI), a CSCB predecessor, which rebalanced daily. This daily rebalancing allowed about 250 observations each year with the same set of weights. From 1970–2000, the average of all the annual rebalancing returns was 2.5% – in the same ballpark as the returns calculated for the BCOM.

I believe these rebalancing returns should be added to the weighted average of individual commodity return expectations, plus collateral returns, in determining the capital market assumptions for commodities as an asset class. Further, the rebalancing return might also be considered when combining asset-class capital-market assumptions into estimates of overall portfolio returns.

Conclusion

By taking a practical and informed approach to understanding the rebalancing aspect of commodities allocations in their investment portfolios, investors may be better positioned to harness the real returns of this critical (but sometimes difficult to evaluate) asset class.

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Portfolio Rebalancing and Commodities

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Author Biography

Robert Greer

Scholar in Residence, J.P. Morgan Center for Commodities, University of Colorado Denver Business School

Mr. Robert (Bob) Greer is the first person to define an investable commodity index and is a pioneer in explaining why commodity indexes are an asset class distinct from stocks and bonds. He developed one of the two common methods of explaining sources of commodity index returns and has spoken on this asset class on national television, at industry conferences and trade meetings globally, and at college lectures at Yale, Oxford, Columbia, Princeton and elsewhere.

Mr. Greer's spent eight years managing the commodity index businesses at Daiwa Securities, Chase Manhattan Bank, and JPMorgan before joining PIMCO in 2002 to build their inflation products business. Under his 13 years of leadership PIMCO's commodity business grew from a single pilot account to become the world's largest commodity investment management business, at one time responsible for \$35 billion in accounts. During this time the other inflation strategies for which Mr. Greer had business responsibility (inflation-linked bonds, real estate, and certain multi-asset strategies) also grew so that his lines of business included over \$100 billion in assets under management.

For more than two decades Mr. Greer's primary interest has been the business of commodity investment; so much so that the Chicago Mercantile Exchange has referred to him as "the godfather of commodity investing." He has also published articles on the subject in *The Journal of Portfolio Management*, *The Journal of Derivatives*, *The Journal of Alternative Investments*, and *Pensions & Investments*. He has consulted on the subject of commodities to the CIA, the Bank of England and the New York Fed, and participated in the CFTC's Agricultural Roundtable in April 2008.

Mr. Greer is the editor of *The Handbook of Inflation Hedging Investments*, oriented to the institutional investment community, which was published by McGraw Hill in December 2005. He also is the co-author of *Intelligent Commodity Indexing*, published by McGraw Hill in 2012. Among other activities since retiring from PIMCO, Mr. Greer serves as a Scholar in Residence at the J.P. Morgan Center for Commodities, part of the University of Colorado Denver Business School. In addition, he is a Senior Advisor to CoreCommodity Management LLC. Mr. Greer received a bachelor degree in mathematics and economics from Southern Methodist University and earned an MBA from the Stanford Graduate School of Business.



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J.P. MORGAN CENTER FOR COMMODITIES

UNIVERSITY OF COLORADO
DENVER BUSINESS SCHOOL

Physical Address

J.P. Morgan Center for
Commodities
University of Colorado Denver
Business School
1475 Lawrence Street
Denver, CO 80202

Mailing Address

J.P. Morgan Center for
Commodities
University of Colorado Denver
Business School
Campus Box 165
P.O. Box 173364
Denver, CO 80217

Web

[business.ucdenver.edu/
commodities](http://business.ucdenver.edu/commodities)

Contact

Mr. Matthew Fleming
Program Coordinator
J.P. Morgan Center for
Commodities
University of Colorado Denver
Business School
matthew.fleming@ucdenver.edu
1.303.315.8019