

Diversification Weighted® Performance Evaluation

Short Form Executive Summary for Financial Advisors

October 7, 2014

Introduction

Using the components of the S&P 500 Index, we investigate an alternative, process-driven methodology for index construction and optimization called Diversification Weighting®. We find that when reconstituting the S&P 500 universe from January 1996 through May 2014, using Diversification Optimization™, we achieved annualized outperformance of 427 basis points against the capital-weighted benchmark, and showed favorably against other weighted approaches applied to the same investments universe.

We also introduce diversification measurement for the purpose of context and clarity underpinning Diversification Optimization™.



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Past performance is not fully indicative of future returns. Results in this research paper are hypothetical. Investing involves risks, including loss of principal and failing to achieve goals or expected results. A diversification based strategy cannot guarantee any level of performance or risk reduction. For distribution to financial professionals only.

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Overview

Investors hold diversification, long a bedrock of investor prudence, in high esteem. This is curious, as diversification is both ubiquitous and so misunderstood. Diversification is typically associated with asset allocation, but fundamentally, diversification is a weighting strategy. We have formalized diversification as a weighting approach.

We believe that Diversification Weighting® is both unique and often superior to conventional weighting approaches. Importantly, it is not constrained to a particular market, style, or even asset class. In addition, we show portfolio diversification to provide material performance improvements to both risk and return.

Part of the attraction to smart beta euphoria is an intuition that repeatable investment performance is systematic. Investors prefer a repeatable process and especially a process rooted in things that are rather simple and easily understood.

“It is impossible for anyone to begin to learn that which he thinks he already knows.” *Epictetus, Greek Philosopher (c 55 – 135 ad)*. Diversification, as a concept, has been around for a long time, but only in vague or indefinite terms. This paper circumscribes various inventions for diversification measurement, visualization, and optimization, but a full treatment of all of these topics is beyond the scope of this article. The question we mean to address here is, “Does diversification work?”

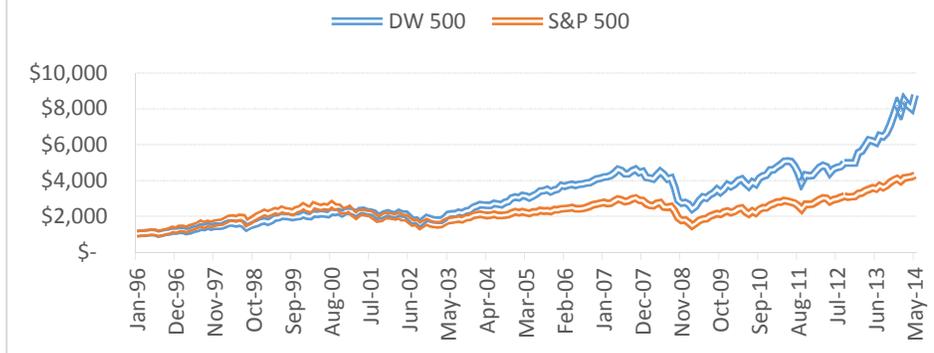
In essence, diversification increases for every equally weighted, uncorrelated asset added to a portfolio. When we put the portfolio in a geometric space, such additions add a dimension, which may measure the diversification therein. When we weight assets in a manner consistent with maximizing the portfolio dimensionality, perhaps subject to a utility function, the portfolio is said to be Diversification Weighted®.

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PERFORMANCE COMPARISONS: DIVERSIFICATION WEIGHTED 500 TO CAPITALIZATION WEIGHTED



In aggregate, the Diversification Weighted[®] 500 outperformed the index by 427 basis points per year, net of fees.

The Diversification Weighted[®] Strategy is reported net of fees, estimated at 90 basis points and net of an estimated 20 basis points trading costs.

Clearly, the performance looks good against a capitalization-weighted approach. What about other weighting approaches? The benefit of diversification is subtle, yet so consistent, that its effects are substantial, much like gravity.

Returns

	1 Year	3 Year	5 Year	10 year	Inception
Diversification Weighted [®]	40.0%	19.6%	23.1%	16.6%	12.4%
Equal Weighted	20.6%	15.6%	21.3%	10.1%	10.8%
Fundamental Weighted	18.9%	16.4%	20.5%	10.1%	11.4%
Market Cap	20.3%	15.0%	17.5%	7.5%	7.9%
Revenue Weighted	22.0%	16.4%	18.9%		
Earnings Weighted	19.9%	15.5%	17.3%		
Volatility Weighted	15.8%	14.4%			

Index data provided by Research Affiliates and Guggenheim Investments. The equal weighted and fundamentally weighted strategies are reported gross of fees and trading cost. The remaining assets are based on the ETF products, which report net fees. Dividends are reinvested. Before 2010, The DW 500 sectors and sector comparisons have their daily returns adjusted to receive the S&P 500 annual dividend yield. (<http://www.multpl.com/>)

Risk Analysis

A few weighting approaches were excluded from the risk table, as the maximum drawdown statistic requires comparable histories for accurate comparison, and risk stats for any product having not lived through the crisis of 2008 seem trite.

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10 Year Risk Values

	St. Deviation	Semi Variance	Max Drawdown
Diversification Weighted®	18.9%	13.5%	53.3%
Fundamental Weighted	19.0%	13.3%	55.2%
Market Cap Weighted	20.4%	14.3%	55.4%
Equal Weighted	20.8%	14.6%	59.5%

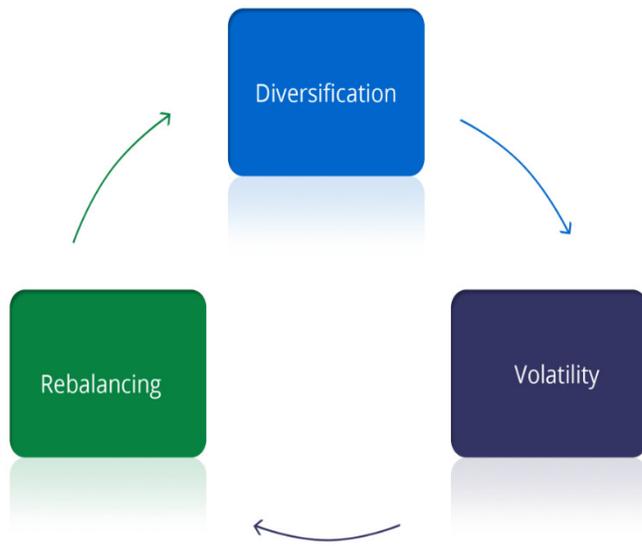
To the chagrin of efficient market theorists the Diversification Weighted® strategies in most cases produces higher returns while lowering the portfolio variance. This hypothesizes massive market inefficiency, perhaps induced by the trillions of dollars attached to capitalization- weighted approaches.

Diversification Return, Diversification Alpha™

Just like Deion Sanders on the field, diversification goes both ways. Most investors intuit the benefit of defensive diversification, but diversification can play offense, too. The defensive ability of diversification to protect capital is a function of the non-correlation and is available to all investors. *Diversification Returns and Asset Contributions* (see Booth & Fama 1992,) represents an additive portfolio return attributed to diversification. Booth & Fama approximated this as ½ the variance reduction in the portfolio given by diversification. For the most recent Diversification Weighted® 500, the weighted average asset variance is 9.35, corresponding to a standard deviation of 30.57%. The portfolio variance is 1.35%, corresponding to a standard deviation of 11.64%. The weighted average asset variance would be the portfolio variance if the correlations were all 1. The difference in variance, 8% provides a 4.00% annual diversification return.

The offensive capabilities of diversification or Diversification Alpha™ can be substantial too. Diversification Alpha™ is not available to all investors, as passive strategies cannot collect the alpha.

The alpha is made possible by exploiting diversification, volatility and some sort of trading activity, such as rebalancing but it can be other activity such as reconstitution or reoptimization. This trilogy of portfolio variables combines the idiosyncratic asset volatility to produce alpha. Due to research limitations, the DW® 500 strategy had reoptimization, but was constrained to no rebalancing benefit. This is another fertile research topic.



More rebalancing, more diversification (non-correlation) and, contrary to MPT, more volatility, are all catalysts to increase this level of alpha. The affect is a veritable profits ratchet, which relates to Parrondo's paradox (see Stutzer, The Paradox of Diversification (Stutzer, Spring, 2010)). This strategy is implemented at some large investment managers such as Parametric and Janus Intech. Our index construction technique enables a more efficient capture of the Diversification Alpha™, due to the optimization's focus on diversification and the ability to include risk at the manager's discretion.

Diversification Alpha™ is very similar to a rebalancing bonus; however, Diversification Alpha™ is a more appropriate moniker because the alpha is

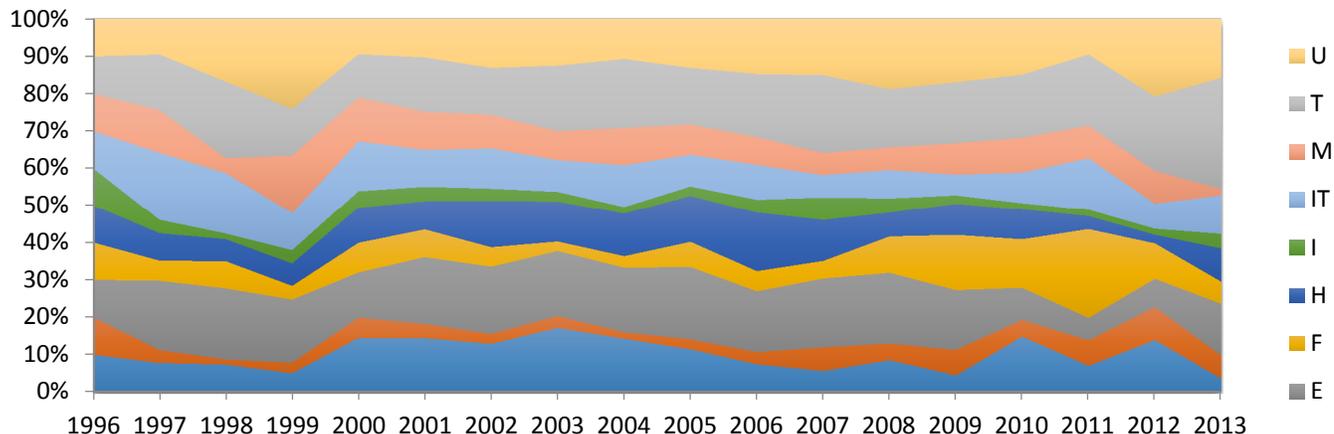
available to investors without rebalancing at all. Other forms of portfolio activity produce the alpha; reconstitution, reoptimization, profit taking, stop loss, trimming, and dollar cost averaging. In all cases, the alpha requires diversification.

Sector Analysis

Only the industrials sector underperformed. Curiously, the Diversification Weighted® technology sector showed material underperformance during the late 1990's.

The sector allocation also reveals an interesting and intuitive dynamic: whenever the market heats up, asset correlations tend to come in, leaving the investor with relatively fewer diversification sources. Telecom and utilities are the largest active weights of the Diversification Weighted® strategy. We note in the Sector Allocation Weight chart that allocations to these less alluring sectors have increased going into a market peak. These investments have acted as a buttress to the portfolio performance. This underscores an interesting behavioral tenet: diversification, systematically applied, works as a check on emotional overreactions and is a way of imposing systematic and sound investment discipline into the strategy.

Sector Allocation Weights Diversification Weighted® 500



Factor Analysis & MPT

Crucially, The Diversification Weighted® 500 produced 652 basis points of alpha every year on average for over 18 years. The alpha for the five-factor model is 414 basis points. The statistical significance of the beta-factor alpha is observed having a P value of .00014, or a chance of the alpha being obtained randomly less than one in 7000. Remarkably, the alpha was demonstrated purely by the weighting approach, as the product had naïve security selection, no timing, leverage, shorting, hedging or other positional risk management and invested in all the same underlying components of the benchmark. The DW® 500 shows an R2 of .80 to a single factor market risk, and a R2 of .83 to a five-factor model. It had statistically insignificant factor exposures to size, momentum and the risk free rate. The value factor gave a positive exposure, with a coefficient of .23. For the analysis period, value paid investors 2.09% annually, which boosted the returns to the DW 500 by 49 basis points. We expect this as an artifact of the focus on diversification.

Conclusion

Since January 1996, the DW® 500 Index Strategy earned a net annual return of 12.40%, which bested all other weighting approaches including capitalization weighting by 427 basis points annually.

The Diversification Weighted® 500 demonstrates material and consistent outperformance against other weighting approaches in all conditions other than the most vertical bull market of the late 90s.

We explain Diversification Optimization™ contrast it versus other weighting approaches. We quantify the Diversification Return at 4.00% and delineate it from the Diversification Alpha™. We further introduce the ability to stack the Diversification Alpha™ at the security, sector and asset class level.

The flexibility and efficacy of Diversification Optimization™, combined with the demonstrated consistency, attractive risk metrics and total return presents a strong case for the institutional application of Diversification Weighting® as an overlay weighting strategy, product sleeve, core-satellite model or index.

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About the Author

James founded Gravity Investments in 2000 at the age of 26. His inventions for diversification measurement, optimization, search and visualizations form the core of the visionary technology; Gsphere, which has helped about 100 clients, such as investments managers, registered investment advisors, hedge funds, allocators and fund consultants manage or advise over twenty billion dollars. This experience allowed James to architect and engineer dozens of investment processes used by diverse clients. It is James's vision to build technology to enable the combination of the best ideas and methodologies of our clients, or other proven strategies with our best practices in essential but overlooked dimensions of any investment process, all rooted in True Diversification®. James has developed unique skills for investment managers or even financial engineers, having expertise in quantitative finance, genetic algorithms, econometrics, database design, computational geometry, data visualization and modeling. Prior to forming Gravity Investments, he was a floor broker at the Chicago Mercantile Exchange, a program trader and an investment advisor.



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