The Bedokian Portfolio and the US Market

The Bedokian

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Contents

Abstract

This paper dealt with the backtesting of The Bedokian Portfolio using the United States (US) market data, making use of investment vehicles available from the US financial markets. Utilising an online portfolio backtesting tool, this paper looked into the performance of The Bedokian Portfolio itself, and comparisons against other established and known asset class portfolios using commonly used financial metrics. Variations of The Bedokian Portfolio were also tested and compared using different investment vehicles and securities.

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Introduction

The Bedokian Portfolio ebook was released in July 2016, in which it introduced an investment model that could generate passive income through dividend and index investing from an asset class portfolio approach. Five types of asset classes are identified for the makeup of The Bedokian Portfolio, namely equities, bonds, real estate investment trusts (REITs), commodities (gold, silver and oil) and cash. The balanced Bedokian Portfolio (or the basic asset allocation) is made up of 35% equities, 35% REITs, 20% bonds, 5% commodities and 5% cash.

The Bedokian Portfolio is meant to be flexible in terms of the asset allocation using the mentioned asset classes, depending on the age and risk appetite of the individual investor. It could also be managed actively or passively, or a hybrid of both with a core-satellite portfolio approach.

This paper looks at the scenario of The Bedokian Portfolio being implemented in the US markets. Using an online backtesting tool called Portfolio Visualizer (www.portfoliovisualizer.com), The Bedokian Portfolio's performance is measured with metrics commonly used to gauge portfolio returns and risk. Using the same said tool, it is also compared with other well-known asset allocation portfolios such as the traditional Stocks/Bonds 60/40, The Bogleheads Three Fund, The Permanent Portfolio, etc. Two different permutations of The Bedokian Portfolio using different sub-asset classes are also tested and compared.

Assumptions and Methodology

Data Source

The data source was generated from the Portfolio Visualizer website, which in turn were obtained from other sources[1]. Portfolio Visualizer itself had stated the following on data accuracy:

"*Historical data for annual asset class returns is not 100% reliable and authoritative sources often differ on exact returns for a particular investment. Typical differences for historical asset class returns based on the data source are below 50 basis points. Data for U.S. and Canadian securities, mutual funds, and ETFs is provided by Commodity Systems Inc. The capital gains and dividends for mutual funds are typically reflected within two weeks of the payment date, for ETFs they are typically reflected by the next business day.*"[2]

Basic Portfolio Assumptions

All portfolios in this report were subjected to the following conditions:

- Initial capital of 10,000 United States Dollars ($)
- Rebalancing back to its original portfolio makeup was done on an annual basis, without any additional capital injection
- All dividends and distributions were reinvested
- Transaction costs and taxes were not factored into the calculations

Backtest Time Periods

A total of three time periods were used, namely 1994 to 2016, 2001 to 2016 and 2007 to 2016.

The rationale for the period of 1994 to 2016 was used as the earliest data for REITs started in 1994. The rationale for the period of 2001 to 2016 was used as the earliest data for Treasury Inflation Protected Securities (TIPS) started in 2001 (to bring in the Yale Endowment Portfolio for comparison). The rationale for the period of 2007 to 2016 was used as the earliest data for commodities started in 2007 (to bring in the Ivy Portfolio for comparison).

These periods were deemed to be appropriate for the study as it represented a period of 23 years (1994 to 2016), 16 years (2001 to 2016) and 10 years (2007 to 2016), which fell within the typical long-term investment time horizons (>= 10 years).

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[1] *Portfolio Visualizer. Frequently Asked Questions. Data Sources for Asset Class Returns* https://www.portfoliovisualizer.com/faq *(accessed 9 Aug 2017)*
[2] *Portfolio Visualizer. Frequently Asked Questions. Data Accuracy* https://www.portfoliovisualizer.com/faq *(accessed 9 Aug 2017)*

Selected Portfolios

The following portfolios were selected for comparison in this paper:

- The Bedokian Portfolio – The balanced Bedokian Portfolio was used, consisting of 35% equities, 35% REITs, 20% bonds, 5% commodities and 5% cash.[3] Using the Portfolio Visualizer, the asset class allocation used were 35% US Stock Market (equities), 35% REIT, 20% Total US Bond Market (bonds), 5% Gold (commodities) and 5% Cash.
- 60/40 Stock/Bond – One of the famous simple asset allocations, with 60% equities and 40% bonds. Using the Portfolio Visualizer's default allocation, 60% US Stock Market (equities) and 40% Total US Bond Market (bonds) were used.
- Bogleheads' Three Fund – The Bogleheads' Three-Fund utilised US domestic equities, international equities and bonds. According to Bogleheads wiki page, the allocation was dependent on the individual's choice.[4] Using the Portfolio Visualizer's default allocation for this portfolio, it would be 50% US Stock Market (representing domestic equities), 30% Global ex-US Stock Market (representing international equities) and 20% Total US Bond Market.
- The Permanent Portfolio – The Permanent Portfolio was created by Harry Browne and it consisted of 25% equities, 25% bonds (specifically long term US Treasury bonds), 25% gold and 25% cash.[5] Using the Portfolio Visualizer's allocation for The Permanent Portfolio, it would be 25% US Stock Market (equities), 25% Long Term Treasury (bonds), 25% Gold and 25% Cash.
- Yale Endowment Portfolio – David Swensen, currently Chief Investment Officer of Yale's Investment Office, which manages the Yale's Endowment[6], was credited with this portfolio. Although the Yale Endowment's portfolio was made up of more sophisticated investment approaches such as leveraged buy-outs and venture capital[7], Swensen had devised a simpler portfolio for the individual investor, that of 30% domestic equity, 15% foreign developed equity, 5% emerging market equity, 20% real estate, 15% US Treasury bonds and 15% TIPS.[8] Using the Portfolio Visualizer's allocation for the Yale Endowment Portfolio, it would be 30% US Stock Market, 15% International Developed ex-US Market, 5% Emerging Markets, 15% Long Term Treasury, 15% TIPS and

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[3] *The Bedokian Portfolio p69*

[4] *Three Fund Portfolio. Bogleheads Wiki. https://www.bogleheads.org/wiki/Three-fund_portfolio (accessed 9 Aug 2017)*

[5] *Rowland, Craig & Lawson, J.M. The Permanent Portfolio p3. John Wiley & Sons, Inc. 2012*

[6] *The Yale Investments Office. http://investments.yale.edu (accessed 9 Aug 2017)*

[7] *The Yale Investments Office. Asset Allocation. http://investments.yale.edu (accessed 9 Aug 2017)*

[8] *Arnold, Chris. Yale's Money Guru Shares Wisdom With Masses. NPR. 5 Oct 2006. http://www.npr.org/templates/story/story.php?storyId=6203264 (accessed 9 Aug 2017)*

20% REIT (for real estate).
- The Ivy Portfolio – From the book of the same name by Mebane T. Faber and Eric W. Richardson, the Ivy Portfolio was a simple portfolio using the strategies employed by the Yale and Harvard endowments. There were a few portfolio combinations mentioned, but the simplest would be 20% domestic stocks, 20% foreign stocks, 20% bonds, 20% real estate and 20% commodities[9], represented in the Portfolio Visualizer's default Ivy Portfolio of 20% US Stock Market, 20% Global ex-US Stock Market, 20% Total US Bond Market, 20% REIT and 20% Commodities, respectively.

Benchmark

The Vanguard 500 Index Fund was used by the Portfolio Visualizer as the benchmark, thus it was adopted for this paper as well. The Vanguard 500 Index Fund was consisted of US domestic equities of 500 of the largest US companies.[10] This would be a good representation of a 100% equity portfolio, typically used in portfolio benchmarking and comparison.

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[9] *Faber, Mebane T. & Richardson, Eric W. The Ivy Portfolio p62. John Wiley & Sons, Inc. 2009*
[10] *Vanguard. Vanguard 500 Index Fund Investor Series.*
https://personal.vanguard.com/us/funds/snapshot?FundIntExt=INT&FundId=0040 (accessed 9 Aug 2017)

Returns Results

<u>Metrics</u>

The following metrics were used to measure the returns results:

- Final Balance – This was the final balance as at end 2016, from the initial $10,000 capital.
- Compound Annual Growth Rate (CAGR) – CAGR measured the average growth rate of the investment over the set period of time.
- Best Year and Worst Year – The Best Year and Worst Year showed the largest percentage gain and loss of the investment on an annual basis, not factoring in inflation.

<u>Inflation</u>

Inflation was included in the form of inflation adjusted final balance and inflation adjusted CAGR. This showed the true current value of the investment returns at the end of the period. Inflation data was obtained from the Consumer Price Index (CPI-U) from the US Bureau of Labor and Statistics.[11]

<u>Returns Results for January 1994 to December 2016</u>

Portfolio	Final Balance	Inflation Adjusted End Balance	CAGR	Inflation Adjusted CAGR	Best Year	Worst Year
Bedokian Portfolio	$67,482	$40,752	8.66%	6.30%	25.39%	-24.59%
Stocks/Bonds 60/40	$58,615	$35,397	7.99%	5.65%	28.74%	-20.20%
Bogleheads Three Funds	$51,637	$31,183	7.40%	5.07%	28.57%	-30.74%
Permanent Portfolio	$42,266	$25,524	6.47%	4.16%	18.14%	-2.98%
Vanguard 500 Index Fund	$73,658	$44,482	9.07%	6.70%	37.45%	-37.02%

Fig. 1 – Returns Results for Jan 1994 to Dec 2016, with initial investment of $10,000

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[11] *Portfolio Visualizer. Frequently Asked Questions. Data Sources for Asset Class Returns. https://www.portfoliovisualizer.com/faq (accessed 9 Aug 2017)*

Returns Results for January 2001 to December 2016

Portfolio	Final Balance	Inflation Adjusted End Balance	CAGR	Inflation Adjusted CAGR	Best Year	Worst Year
Bedokian Portfolio	$33,824	$24,377	7.91%	5.73%	25.39%	-24.59%
Yale Endowment	$31,928	$23,011	7.53%	5.35%	26.82%	-24.40%
Permanent Portfolio	$27,188	$19,595	6.45%	4.29%	14.20%	-2.98%
Stocks/Bonds 60/40	$25,124	$18,107	5.93%	3.78%	20.40%	-20.20%
Bogleheads Three Funds	$23,701	$17,081	5.54%	3.40%	28.57%	-30.74%
Vanguard 500 Index Fund	$22,854	$16,471	5.30%	3.17%	32.18%	-37.02%

Fig. 2 – Returns Results for Jan 2001 to Dec 2016, with initial investment of $10,000

Returns Results for January 2007 to December 2016

Portfolio	Final Balance	Inflation Adjusted End Balance	CAGR	Inflation Adjusted CAGR	Best Year	Worst Year
Stocks/Bonds 60/40	$18,748	$15,670	6.49%	4.59%	19.59%	-20.20%
Bedokian Portfolio	$18,079	$15,111	6.10%	4.22%	22.79%	-24.59%
Yale Endowment	$17,856	$14,925	5.97%	4.09%	22.38%	-24.40%
Permanent Portfolio	$17,698	$14,793	5.87%	3.99%	13.85%	-2.98%
Bogleheads Three Funds	$16,509	$13,799	5.14%	3.27%	26.55%	-30.74%
Ivy Portfolio	$12,814	$10,710	2.51%	0.69%	22.43%	-31.78%
Vanguard 500 Index Fund	$19,352	$16,175	6.82%	4.93%	32.18%	-37.02%

Fig. 3 – Returns Results for Jan 2007 to Dec 2016, with initial investment of $10,000

Returns Results Observations

From Fig. 1, the period of January 1994 to December 2016 saw The Bedokian Portfolio's returns trumping the others save for the benchmark Vanguard 500 Index Fund. For the period of January 2001 to December 2016 (Fig. 2), it came out tops in terms of returns, followed closely by the Yale Endowment portfolio. However for the period of January 2007 to December 2016 (Fig. 3), it fell short of the benchmark as well as the Stocks/Bonds 60/40 portfolio, although most other portfolios were coming in close.

It was noteworthy to see that the Worst Year result from the three periods for The Bedokian Portfolio was the same figure (-24.59%), and it happened in 2008, the height of the Global Financial Crisis (GFC). All other portfolios (with the exception of the Permanent Portfolio), the worst year also came in at 2008. Fig. 4 below showed the returns of the asset classes and the overall Bedokian Portfolio per year from 1994 to 2016.

Year	US Stock Market	Cash	Total US Bond Market	REIT	Gold	Bedokian Portfolio Return
1994	-0.17%	3.90%	-2.66%	-8.40%	-2.09%	-3.44%
1995	35.79%	5.60%	18.18%	12.13%	1.10%	20.74%
1996	20.96%	5.20%	3.58%	33.84%	-4.43%	19.94%
1997	30.99%	5.25%	9.44%	18.77%	-21.74%	18.48%
1998	23.26%	4.85%	8.58%	-16.32%	-0.61%	4.36%
1999	23.81%	4.69%	-0.76%	-4.04%	1.18%	7.06%
2000	-10.57%	5.88%	11.39%	26.35%	-6.26%	7.78%
2001	-10.97%	3.82%	8.43%	12.35%	1.41%	2.43%
2002	-20.96%	1.63%	8.26%	3.75%	23.96%	-3.09%
2003	31.35%	1.02%	3.97%	35.66%	21.74%	25.39%
2004	12.52%	1.19%	4.24%	30.76%	4.97%	16.30%
2005	5.98%	2.98%	2.40%	11.89%	17.76%	7.77%
2006	15.51%	4.81%	4.27%	35.07%	22.55%	19.93%
2007	5.49%	4.67%	6.92%	-16.46%	30.45%	-0.70%
2008	-37.04%	1.59%	5.05%	-37.05%	4.92%	-24.59%
2009	28.70%	0.09%	5.93%	29.58%	24.03%	22.79%
2010	17.09%	0.10%	6.42%	28.30%	29.27%	18.64%
2011	0.96%	0.04%	7.56%	8.47%	9.57%	5.29%
2012	16.25%	0.06%	4.05%	17.53%	6.60%	12.96%
2013	33.35%	0.00%	-2.26%	2.31%	-28.33%	10.61%
2014	12.43%	0.00%	5.76%	30.13%	-2.19%	15.94%
2015	0.29%	0.01%	0.30%	2.22%	-10.67%	0.41%
2016	12.53%	0.21%	2.50%	8.34%	8.03%	8.22%

Fig. 4 – Annual returns of each asset class and overall Bedokian Portfolio from Jan 1994 to Dec 2016

Drilling down the returns by year, the equities and REITs asset classes plunged; -37.04% and -37.05% respectively, only to be propped up by slight positive gains from bonds (+5.05%), gold (+4.92%) and cash (+1.59%). However, the second worst year was at 1994, at -3.44%, which saw all asset classes except Cash in the negative.

This observation had reinforced the fact that different asset classes behave differently in various economic conditions, in the form of differing correlations with one another. Diversification of asset classes also minimise the risk to the

portfolio. In most years in Fig. 4, the returns were varied across all the asset classes, which was supposed to happen.

The anomaly came in 2008, where both equities and REITs plunged drastically. Since these two asset classes made up of 70% of The Bedokian Portfolio, they gave the portfolio a big drop of -24.59%. According to a University of Texas at Austin study[12], it had been established that the more heavily leveraged a REIT was, especially when there was a huge amount of debt due during that crisis period, the worse it performed. This in turn forced the REITs to sell off property at unattractive prices and issued lower equity value to meet the loan terms. This could probably explain why equities and REITs shared the same correlation during that time.

The annual returns of the other portfolios are shown in Appendix A.

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[12] *Dawson, Adrienne. Where REITs Went Wrong. Texas Enterprise. 16 December 2013.* http://www.texasenterprise.utexas.edu/2013/12/16/research-brief/where-reits-went-wrong *(accessed 12 Aug 2017)*

Risk Results

Metrics

Common portfolio risk metrics were used to measure the risk results. They are:

- Standard Deviation – The standard deviation measured the volatility of the portfolio with reference to its average, or mean, value. Annual standard deviation was used for this paper. A lower number denote lesser volatility.
- Sharpe Ratio – The Sharpe Ratio, developed by William Sharpe, measured a portfolio's average return above the risk-free rate over the said portfolio's standard deviation. The higher the ratio, the better.
- Sortino Ratio – The Sortino Ratio, developed by Frank Sortino, shared similar measurements to that of the Sharpe Ratio, but only the negative deviation was used, instead of the standard deviation used by the latter. The higher the ratio, the better.
- Historical Value at Risk (VaR) – The historical VaR was used and it was based on portfolio monthly returns with a 95% confidence level. This means what would be the loss of the portfolio in terms of percentage on a 5% probability per month.

Risk Results for January 1994 to December 2016

Portfolio	Final Balance	Standard Deviation	Sharpe Ratio	Sortino Ratio	Historical Value-at-Risk (95%)
Bedokian Portfolio	$67,482	10.79%	0.6	0.86	-3.96%
Stocks/Bonds 60/40	$58,615	9.00%	0.63	0.93	-4.01%
Bogleheads Three Funds	$51,637	11.97%	0.45	0.64	-5.94%
Permanent Portfolio	$42,266	6.16%	0.65	1.04	-2.21%
Vanguard 500 Index Fund	$73,658	14.71%	0.5	0.72	-7.14%

Fig. 5 – Risk Results for Jan 1994 to Dec 2016

Risk Results for January 2001 to December 2016

Portfolio	Final Balance	Standard Deviation	Sharpe Ratio	Sortino Ratio	Historical Value-at-Risk (95%)
Bedokian Portfolio	$33,824	11.79%	0.59	0.84	-4.40%
Yale Endowment	$31,928	11.12%	0.59	0.84	-4.92%
Permanent Portfolio	$27,188	6.47%	0.79	1.3	-2.29%
Stocks/Bonds 60/40	$25,124	8.76%	0.54	0.79	-4.38%
Bogleheads Three Funds	$23,701	12.32%	0.39	0.55	-6.77%
Vanguard 500 Index Fund	$22,854	14.75%	0.33	0.46	-7.82%

Fig. 6 – Risk Results for Jan 2001 to Dec 2016

Risk Results for January 2007 to December 2016

Portfolio	Final Balance	Standard Deviation	Sharpe Ratio	Sortino Ratio	Historical Value-at-Risk (95%)
Stocks/Bonds 60/40	$18,748	9.31%	0.65	0.96	-4.54%
Bedokian Portfolio	$18,079	13.49%	0.46	0.64	-6.36%
Yale Endowment	$17,856	12.54%	0.47	0.67	-5.03%
Permanent Portfolio	$17,698	7.14%	0.74	1.22	-2.50%
Bogleheads Three Funds	$16,509	13.16%	0.4	0.57	-7.04%
Mebane Faber Ivy Portfolio	$12,814	13.93%	0.2	0.27	-7.27%
Vanguard 500 Index Fund	$19,352	15.28%	0.47	0.67	-7.95%

Fig. 7 – Risk Results for Jan 2007 to Dec 2016

Risk Results Observation

In all three periods, the Permanent Portfolio stood out with the best score overall, which was due to its conservative asset allocation nature. On volatility (standard deviation), The Bedokian Portfolio stood out to be around average to below average for the three periods.

The Bedokian Portfolio's Sharpe and Sortino ratios over the three periods beat

the benchmark and returned as overall third for the first period and second for the remaining two periods. For the all 100% equity portfolio in the benchmark, the amount of volatility taken in did not commensurate with the returns as compared to The Bedokian Portfolio's.

The historical VaR for The Bedokian Portfolio, like some portfolios demonstrated here, was reduced as the time period gets longer. This showed that a portfolio will be "stabilised" if it was held longer due to the multiple economic cycles it went through.

Variations of The Bedokian Portfolio

Two other combinations of The Bedokian Portfolio were tested. The first variation used overseas securities, in line with The Bedokian Portfolio's 10% to 30% ball park figure for overseas exposure.[13] For this combination, 15% of equities and 10% of bonds would be foreign-based. Hence the portfolio combination would be 20% US Stock Market, 15% Global ex-US Stock Market, 10% Total US Bond Market, 10% Global Bonds (unhedged), 35% REITs, 5% Gold and 5% Cash.

The second variation involved the total replacement of the Total US Bond Market with Long Term Treasury. The Portfolio Visualizer used the Vanguard VUSTX fund as the basis of returns. The VUSTX contains US government bonds with an average duration of 15 years.[14] This was in line with The Bedokian Portfolio's emphasis on having at least investment grade bonds.[15] So the portfolio would be 35% US Stock Market, 20% Long Term Treasury, 35% REITs, 5% Gold and 5% Cash.

Variation Returns Results for January 1994 to December 2016

Using the same returns results metrics used above, inflation considerations and benchmark with a base capital of $10,000, the following were the returns results for the three said periods (1994-2016, 2001-2016 and 2007-2016).

Portfolio	Final Balance	Inflation Adjusted End Balance	CAGR	Inflation Adjusted CAGR	Best Year	Worst Year
Bedokian Portfolio (treasuries)	$74,995	$45,289	9.16%	6.79%	25.13%	-21.10%
Bedokian Portfolio	$67,482	$40,752	8.66%	6.30%	25.39%	-24.59%
Bedokian Portfolio (overseas)	$59,615	$36,001	8.07%	5.73%	28.00%	-26.43%
Vanguard 500 Index Fund	$73,658	$44,482	9.07%	6.70%	37.45%	-37.02%

Fig. 8 – Bedokian Portfolio Variation Returns Results for Jan 1994 to Dec 2016, with initial investment of $10,000

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[13] *The Bedokian Portfolio p109-110*

[14] *Vanguard. Vanguard Long-Term Treasury Fund Investor Shares.* https://personal.vanguard.com/us/funds/snapshot?FundIntExt=INT&FundId=0083 *(accessed 13 Aug 2017)*

[15] *The Bedokian Portfolio p100-101*

Portfolio	Final Balance	Inflation Adjusted End Balance	CAGR	Inflation Adjusted CAGR	Best Year	Worst Year
Bedokian Portfolio (treasuries)	$36,889	$26,586	8.50%	6.30%	25.13%	-21.10%
Bedokian Portfolio	$33,824	$24,377	7.91%	5.73%	25.39%	-24.59%
Bedokian Portfolio (overseas)	$33,171	$23,906	7.78%	5.60%	28.00%	-26.43%
Vanguard 500 Index Fund	$22,854	$16,471	5.30%	3.17%	32.18%	-37.02%

Fig. 9 – Bedokian Portfolio Variation Returns Results for Jan 2001 to Dec 2016, with initial investment of $10,000

Variation Returns Results for January 2007 to December 2016

Portfolio	Final Balance	Inflation Adjusted End Balance	CAGR	Inflation Adjusted CAGR	Best Year	Worst Year
Bedokian Portfolio (treasuries)	$19,413	$16,226	6.86%	4.96%	19.84%	-21.10%
Bedokian Portfolio	$18,079	$15,111	6.10%	4.22%	22.79%	-24.59%
Bedokian Portfolio (overseas)	$16,686	$13,947	5.25%	3.38%	25.12%	-26.43%
Vanguard 500 Index Fund	$19,352	$16,175	6.82%	4.93%	32.18%	-37.02%

Fig. 10 – Bedokian Portfolio Variation Returns Results for Jan 2007 to Dec 2016, with initial investment of $10,000

Variation Returns Results Observations

It was surprising to see that The Bedokian Portfolio with long term treasury for all three periods trumped in returns, not just in the variations shown in *Figs. 8, 9 and 10*, but also for *Figs. 1, 2 and 3*. The Bedokian Portfolio with overseas exposure did not fare very well as compared to the US-only Bedokian Portfolio, though for the period of 2001 to 2016 it almost came close.

Despite having the least Best Year among the three portfolios plus the benchmark, the Bedokian Portfolio (treasuries) gave the highest CAGR. Also, it

gave the best worst year, thus the band of fluctuation, or volatility, between the two extremes was smaller than the rest.

Replacing the Total US Bond Fund with Long Term Treasury had indeed boosted the returns. One of the reasons could be that the although the Total US Bond Fund is made up of investment grade bonds, 30% of it are from corporates[16], which somehow may be correlated to its equity counterpart.

Refer to Appendix B for the annual returns of the two variations.

Variation Risk Results

Using the same risk results metrics used above (Standard Deviation, Sharpe Ratio, Sortino Ratio and Historical VaR (95%)), the following were the risk results for the three said periods (1994-2016, 2001-2016 and 2007-2016).

Variation Risk Results for January 1994 to December 2016

Portfolio	Final Balance	Standard Deviation	Sharpe Ratio	Sortino Ratio	Historical Value-at-Risk (95%)
Bedokian Portfolio (treasuries)	$74,995	10.70%	0.65	0.93	-3.83%
Bedokian Portfolio	$67,482	10.79%	0.6	0.86	-3.96%
Bedokian Portfolio (overseas)	$59,615	11.15%	0.53	0.76	-4.08%
Vanguard 500 Index Fund	$73,658	14.71%	0.5	0.72	-7.14%

Fig. 11 – Bedokian Portfolio Variation Risk Results for Jan 1994 to Dec 2016

Variation Risk Results for January 2001 to December 2016

Portfolio	Final Balance	Standard Deviation	Sharpe Ratio	Sortino Ratio	Historical Value-at-Risk (95%)
Bedokian Portfolio (treasuries)	$36,889	11.62%	0.64	0.92	-4.07%
Bedokian Portfolio	$33,824	11.79%	0.59	0.84	-4.40%
Bedokian Portfolio (overseas)	$33,171	12.34%	0.56	0.8	-4.87%
Vanguard 500 Index Fund	$22,854	14.75%	0.33	0.46	-7.82%

Fig. 12 – Bedokian Portfolio Variation Risk Results for Jan 2001 to Dec 2016

[16] *Vanguard. Vanguard Total Bond Market Index Fund Investor Shares.* https://personal.vanguard.com/us/funds/snapshot?FundIntExt=INT&FundId=0084 *(accessed 14 Aug 2017)*

Variation Risk Results for January 2007 to December 2016

Portfolio	Final Balance	Standard Deviation	Sharpe Ratio	Sortino Ratio	Historical Value-at-Risk (95%)
Bedokian Portfolio (treasuries)	$19,413	13.30%	0.52	0.73	-4.77%
Bedokian Portfolio	$18,079	13.49%	0.46	0.64	-6.36%
Bedokian Portfolio (overseas)	$16,686	14.16%	0.39	0.54	-6.53%
Vanguard 500 Index Fund	$19,352	15.28%	0.47	0.67	-7.95%

Fig. 13 – Bedokian Portfolio Variation Risk Results for Jan 2007 to Dec 2016

Variation Risk Results Observations

It was obvious that The Bedokian Portfolio variation with Long Term Treasury emerged superior in all risk metrics. The Bedokian Portfolio with overseas exposure fared below to that of the basic Bedokian Portfolio.

Bringing the Bedokian Portfolio (treasuries) portfolio's risk metrics and compared its corresponding periods with *Figs. 5, 6 and 7*, it stood out better than the basic Bedokian Portfolio, although it was still average in terms of volatility (standard deviation) among the other portfolios.

Discussion

In addition to the observations stated in the above sections, here are some topics for further discussion with reference to the results.

Risk Profile of The US Bedokian Portfolio Investor

From the results in *Figs. 5, 6 and 7*, The Bedokian Portfolio displayed higher volatility than the traditional Stocks/Bonds 60/40 portfolio in all three periods. If provided with this information, The Bedokian Portfolio investor would have had a higher risk tolerance, and likely go for a higher risk in terms of volatility to obtain higher returns (as displayed in *Figs. 1 and 2)*.

Increase Returns with Individual Securities

As The Bedokian Portfolio in this study were using funds and thus provided an average return across the asset classes they replicated, returns could be increased if individual companies' securities (e.g. shares, bonds and REITs) were included in the portfolio. An example of implementation would be through the core-satellite approach.[17]

The REIT Allocation

The unique point about The Bedokian Portfolio is that the REIT asset class allocation is one of the highest (and unusually) among the other portfolios. Both the Yale Endowment and Ivy portfolios shown here have 20% REITs, and that is a lot as compared to the other US-based portfolios not shown in this paper. The explanation for this high allocation to REITs is due to The Bedokian Portfolio's emphasis on dividend investing (Note: Due to their tax structure, REITs have to distribute at least 90% of their taxable income), which is in line with its "passive income through dividend and index investing" statement.

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[17] *The Bedokian Portfolio, p122-123*

Conclusion

The Bedokian Portfolio has shown to be suitable for the US markets as well, with delivery of better than average returns, though at a risk level similar to other portfolios used in this study.

However, the study is deemed incomplete without the inclusion of practical factors such as transaction costs and tax considerations. Furthermore since the data and information for this paper is from one source, it is preferred that multiple sources would be used to give a far more comprehensive and comparative study. It is hoped that these would be further explored in order to give a more complete picture of The US Bedokian Portfolio in action.

Appendix A – Annual Returns of Other Portfolios Used In This Paper

Year	Vanguard 500 Index Fund Return
1994	1.18%
1995	37.45%
1996	22.86%
1997	33.21%
1998	28.62%
1999	21.07%
2000	-9.06%
2001	-12.02%
2002	-22.15%
2003	28.50%
2004	10.74%
2005	4.77%
2006	15.64%
2007	5.39%
2008	-37.02%
2009	26.49%
2010	14.91%
2011	1.97%
2012	15.82%
2013	32.18%
2014	13.51%
2015	1.25%
2016	11.82%

Fig. A-1 – Annual returns of benchmark, the Vanguard 500 Index Fund

Year	US Stock Market	Total US Bond Market	Stocks/Bonds 60/40 Return
1994	-0.17%	-2.66%	-1.16%
1995	35.79%	18.18%	28.74%
1996	20.96%	3.58%	14.01%
1997	30.99%	9.44%	22.37%
1998	23.26%	8.58%	17.39%
1999	23.81%	-0.76%	13.98%
2000	-10.57%	11.39%	-1.79%
2001	-10.97%	8.43%	-3.21%
2002	-20.96%	8.26%	-9.27%
2003	31.35%	3.97%	20.40%
2004	12.52%	4.24%	9.20%
2005	5.98%	2.40%	4.55%
2006	15.51%	4.27%	11.01%
2007	5.49%	6.92%	6.06%
2008	-37.04%	5.05%	-20.20%
2009	28.70%	5.93%	19.59%
2010	17.09%	6.42%	12.82%
2011	0.96%	7.56%	3.60%
2012	16.25%	4.05%	11.37%
2013	33.35%	-2.26%	19.10%
2014	12.43%	5.76%	9.76%
2015	0.29%	0.30%	0.29%
2016	12.53%	2.50%	8.52%

Fig. A-2 – Annual returns of the Stock/Bond 60/40 portfolio

Year	US Stock Market	Global ex-US Stock Market	Total US Bond Market	Bogleheads Three-Fund Return
1994	-0.17%	9.76%	-2.66%	2.31%
1995	35.79%	3.98%	18.18%	22.72%
1996	20.96%	4.68%	3.58%	12.60%
1997	30.99%	-0.77%	9.44%	17.15%
1998	23.26%	15.60%	8.58%	18.03%
1999	23.81%	29.92%	-0.76%	20.73%
2000	-10.57%	-15.61%	11.39%	-7.69%
2001	-10.97%	-20.15%	8.43%	-9.84%
2002	-20.96%	-15.08%	8.26%	-13.35%
2003	31.35%	40.34%	3.97%	28.57%
2004	12.52%	20.84%	4.24%	13.36%
2005	5.98%	15.57%	2.40%	8.14%
2006	15.51%	26.64%	4.27%	16.60%
2007	5.49%	15.52%	6.92%	8.79%
2008	-37.04%	-44.10%	5.05%	-30.74%
2009	28.70%	36.73%	5.93%	26.55%
2010	17.09%	11.12%	6.42%	13.17%
2011	0.96%	-14.56%	7.56%	-2.38%
2012	16.25%	18.14%	4.05%	14.38%
2013	33.35%	15.04%	-2.26%	20.74%
2014	12.43%	-4.24%	5.76%	6.09%
2015	0.29%	-4.38%	0.30%	-1.11%
2016	12.53%	4.65%	2.50%	8.16%

Fig. A-3 – Annual returns of the Bogleheads Three-Fund portfolio

Year	US Stock Market	Long Term Treasury	Gold	Cash	Permanent Portfolio Return
1994	-0.17%	-7.04%	-2.09%	3.90%	-1.35%
1995	35.79%	30.09%	1.10%	5.60%	18.14%
1996	20.96%	-1.26%	-4.43%	5.20%	5.12%
1997	30.99%	13.90%	-21.74%	5.25%	7.10%
1998	23.26%	13.05%	-0.61%	4.85%	10.14%
1999	23.81%	-8.66%	1.18%	4.69%	5.26%
2000	-10.57%	19.72%	-6.26%	5.88%	2.19%
2001	-10.97%	4.31%	1.41%	3.82%	-0.36%
2002	-20.96%	16.67%	23.96%	1.63%	5.33%
2003	31.35%	2.68%	21.74%	1.02%	14.20%
2004	12.52%	7.12%	4.97%	1.19%	6.45%
2005	5.98%	6.61%	17.76%	2.98%	8.33%
2006	15.51%	1.74%	22.55%	4.81%	11.15%
2007	5.49%	9.24%	30.45%	4.67%	12.46%
2008	-37.04%	22.51%	4.92%	1.59%	-2.00%
2009	28.70%	-12.06%	24.03%	0.09%	10.19%
2010	17.09%	8.92%	29.27%	0.10%	13.85%
2011	0.96%	29.27%	9.57%	0.04%	9.96%
2012	16.25%	3.46%	6.60%	0.06%	6.59%
2013	33.35%	-13.03%	-28.33%	0.00%	-2.00%
2014	12.43%	25.27%	-2.19%	0.00%	8.88%
2015	0.29%	-1.54%	-10.67%	0.01%	-2.98%
2016	12.53%	1.21%	8.03%	0.21%	5.50%

Fig. A-4 – Annual returns of The Permanent Portfolio

Year	US Stock Market	REIT	Intl Developed ex-US Market	Emerging Markets	Long Term Treasury	TIPS	Yale Endowment Return
2001	-10.97%	12.35%	-21.94%	-2.88%	4.31%	7.61%	-2.47%
2002	-20.96%	3.75%	-15.62%	-7.43%	16.67%	16.61%	-3.26%
2003	31.35%	35.66%	38.67%	57.65%	2.68%	8.00%	26.82%
2004	12.52%	30.76%	20.25%	26.12%	7.12%	8.27%	16.56%
2005	5.98%	11.89%	13.60%	32.05%	6.61%	2.59%	9.19%
2006	15.51%	35.07%	26.27%	29.39%	1.74%	0.43%	17.40%
2007	5.49%	-16.46%	11.15%	38.90%	9.24%	11.59%	5.10%
2008	-37.04%	-37.05%	-41.27%	-52.81%	22.51%	-2.85%	-24.40%
2009	28.70%	29.58%	28.27%	75.98%	-12.06%	10.80%	22.38%
2010	17.09%	28.30%	8.36%	18.86%	8.92%	6.17%	15.25%
2011	0.96%	8.47%	-12.51%	-18.78%	29.27%	13.23%	5.54%
2012	16.25%	17.53%	18.56%	18.64%	3.46%	6.77%	13.63%
2013	33.35%	2.31%	22.06%	-5.19%	-13.03%	-8.92%	10.22%
2014	12.43%	30.13%	-5.66%	0.42%	25.27%	3.83%	13.29%
2015	0.29%	2.22%	-0.19%	-15.47%	-1.54%	-1.83%	-0.77%
2016	12.53%	8.34%	2.45%	11.55%	1.21%	4.52%	7.23%

Fig. A-5 – Annual returns of the Yale Endowment portfolio

Year	US Stock Market	Total US Bond Market	REIT	Global ex-US Stock Market	Commodities	Ivy Portfolio Return
2007	5.49%	6.92%	-16.46%	15.52%	31.62%	8.62%
2008	-37.04%	5.05%	-37.05%	-44.10%	-45.75%	-31.78%
2009	28.70%	5.93%	29.58%	36.73%	11.22%	22.43%
2010	17.09%	6.42%	28.30%	11.12%	7.17%	14.02%
2011	0.96%	7.56%	8.47%	-14.56%	-3.28%	-0.17%
2012	16.25%	4.05%	17.53%	18.14%	-0.58%	11.08%
2013	33.35%	-2.26%	2.31%	15.04%	-1.83%	9.32%
2014	12.43%	5.76%	30.13%	-4.24%	-32.96%	2.22%
2015	0.29%	0.30%	2.22%	-4.38%	-34.06%	-7.12%
2016	12.53%	2.50%	8.34%	4.65%	10.12%	7.63%

Fig. A-6 – Annual returns of the Ivy Portfolio

Appendix B – Annual Returns of Bedokian Portfolio Variations

Year	US Stock Market	Global ex-US Stock Market	Total US Bond Market	Global Bonds (Unhedged)	REIT	Gold	Cash	Bedokian Portfolio (overseas) Return
1994	-0.17%	9.76%	-2.66%	-1.71%	-8.40%	-2.09%	3.90%	-1.86%
1995	35.79%	3.98%	18.18%	22.91%	12.13%	1.10%	5.60%	16.44%
1996	20.96%	4.68%	3.58%	10.33%	33.84%	-4.43%	5.20%	18.17%
1997	30.99%	-0.77%	9.44%	-0.90%	18.77%	-21.74%	5.25%	12.68%
1998	23.26%	15.60%	8.58%	12.43%	-16.32%	-0.61%	4.85%	3.59%
1999	23.81%	29.92%	-0.76%	-4.28%	-4.04%	1.18%	4.69%	7.63%
2000	-10.57%	-15.61%	11.39%	0.43%	26.35%	-6.26%	5.88%	5.93%
2001	-10.97%	-20.15%	8.43%	2.48%	12.35%	1.41%	3.82%	0.46%
2002	-20.96%	-15.08%	8.26%	21.33%	3.75%	23.96%	1.63%	-0.90%
2003	31.35%	40.34%	3.97%	16.59%	35.66%	21.74%	1.02%	28.00%
2004	12.52%	20.84%	4.24%	11.57%	30.76%	4.97%	1.19%	18.28%
2005	5.98%	15.57%	2.40%	-6.36%	11.89%	17.76%	2.98%	8.33%
2006	15.51%	26.64%	4.27%	5.85%	35.07%	22.55%	4.81%	21.75%
2007	5.49%	15.52%	6.92%	9.26%	-16.46%	30.45%	4.67%	1.04%
2008	-37.04%	-44.10%	5.05%	-2.68%	-37.05%	4.92%	1.59%	-26.43%
2009	28.70%	36.73%	5.93%	17.17%	29.58%	24.03%	0.09%	25.12%
2010	17.09%	11.12%	6.42%	11.24%	28.30%	29.27%	0.10%	18.23%
2011	0.96%	-14.56%	7.56%	9.20%	8.47%	9.57%	0.04%	3.13%
2012	16.25%	18.14%	4.05%	7.42%	17.53%	6.60%	0.06%	13.59%
2013	33.35%	15.04%	-2.26%	-5.04%	2.31%	-28.33%	0.00%	7.59%
2014	12.43%	-4.24%	5.76%	2.37%	30.13%	-2.19%	0.00%	13.10%
2015	0.29%	-4.38%	0.30%	-3.57%	2.22%	-10.67%	0.01%	-0.68%
2016	12.53%	4.65%	2.50%	4.02%	8.34%	8.03%	0.21%	7.19%

Fig. B-1 – Annual returns of The Bedokian Portfolio , overseas variation

Year	US Stock Market	REIT	Long Term Treasury	Gold	Cash	Bedokian Portfolio (treasuries) Return
1994	-0.17%	-8.40%	-7.04%	-2.09%	3.90%	-4.32%
1995	35.79%	12.13%	30.09%	1.10%	5.60%	23.12%
1996	20.96%	33.84%	-1.26%	-4.43%	5.20%	18.97%
1997	30.99%	18.77%	13.90%	-21.74%	5.25%	19.37%
1998	23.26%	-16.32%	13.05%	-0.61%	4.85%	5.25%
1999	23.81%	-4.04%	-8.66%	1.18%	4.69%	5.48%
2000	-10.57%	26.35%	19.72%	-6.26%	5.88%	9.45%
2001	-10.97%	12.35%	4.31%	1.41%	3.82%	1.61%
2002	-20.96%	3.75%	16.67%	23.96%	1.63%	-1.41%
2003	31.35%	35.66%	2.68%	21.74%	1.02%	25.13%
2004	12.52%	30.76%	7.12%	4.97%	1.19%	16.88%
2005	5.98%	11.89%	6.61%	17.76%	2.98%	8.61%
2006	15.51%	35.07%	1.74%	22.55%	4.81%	19.42%
2007	5.49%	-16.46%	9.24%	30.45%	4.67%	-0.24%
2008	-37.04%	-37.05%	22.51%	4.92%	1.59%	-21.10%
2009	28.70%	29.58%	-12.06%	24.03%	0.09%	19.19%
2010	17.09%	28.30%	8.92%	29.27%	0.10%	19.14%
2011	0.96%	8.47%	29.27%	9.57%	0.04%	9.63%
2012	16.25%	17.53%	3.46%	6.60%	0.06%	12.85%
2013	33.35%	2.31%	-13.03%	-28.33%	0.00%	8.46%
2014	12.43%	30.13%	25.27%	-2.19%	0.00%	19.84%
2015	0.29%	2.22%	-1.54%	-10.67%	0.01%	0.04%
2016	12.53%	8.34%	1.21%	8.03%	0.21%	7.96%

Fig. B-2 – Annual returns of The Bedokian Portfolio, treasuries variation