

# ARTIFICIAL INTELLIGENCE ENHANCES PORTFOLIO DIVERSIFICATION DECISIONS

ANALYSIS FOR A WIDELY UTILIZED MODEL PORTFOLIO  
**(ACCORDING TO 3<sup>RD</sup> RESTATEMENT OF TRUSTS & PRUDENT INVESTOR ACTS)**

Optimized October 28, 2022

## THE PORTFOLIO DIVERSIFICATION TOOLBOX©

This illustrates the *procedural process* for Optimizing Portfolio Diversification Using Artificial Intelligence to Enhance Human Modifying of Asset Allocation & Rebalancing  
(Risk Assets Only because 70% of Uncompensated Risk is in Risk Assets)

## A Widely Utilized Model Portfolio

Optimized October 28, 2022

The Portfolio Diversification Institute

<https://DivToolbox.com/>

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# A WIDELY UTILIZED MODEL PORTFOLIO

## Excel Upload

### 11 Constituent Legacy Portfolio

#	Symbol	Company Name	Allocation
1	XLY	Consumer Discretionary Select Sector SPDR	12.0%
2	XLF	Financial Select Sector SPDR	15.0%
3	IYR	iShares U.S. Real Estate ETF	4.0%
4	XLC	Communication Services Select Sector SPDR Fund	10.0%
5	XLE	The Energy Select Sector SPDR Fund	2.0%
6	XLP	Consumer Staples Select Sector SPDR	5.0%
7	XLI	Industrial Select Sector SPDR	10.0%
8	XLU	Utilities Select Sector SPDR ETF	3.0%
9	XLV	Health Care Select Sector SPDR	14.0%
10	XLB	Materials Select Sector SPDR	5.0%
11	XLK	Technology Select Sector SPDR ETF	20.0%
			100.0%

A portfolio's constituent holdings are easily uploaded to the TOOLBOX'S analytics platform function from an Excel worksheet.

The 56 optimizing securities are the Institute's choices of Proxy ETFs. [See link](#) to view ETFs utilized for this analysis.

Changes to Proxies can easily be made within the platform's policy control setting.

# Your Artificial Intelligent Assistant Creates Portfolio Diversification Alternatives For Your Review

The system automatically creates six new simulated portfolios from the original legacy portfolio, decreasing the legacy's allocation in increments of 10%, 20%, 30%, 40%, 50% and 60%, respectively. The original portfolio's asset weightings are maintained within each portfolio's declining legacy position. Their reciprocal percentages are filled with selected sector and/or industry proxies at weightings calculated by the system's forward looking modeling algorithms to improve diversification outcomes. (*Note: The Institute's algorithm makes its allocation based on data known only at the beginning of the period studied with no knowledge of what happened during the period.*)

All portfolios undergo both quantitative and qualitative risk factor analysis described in the Third Restatement. [See how calculations are made in accordance with Third Restatement.](#)

# Portfolios & Benchmark

## Comparative Performance Metrics



Performance Metrics								
Indices and Portfolios	FTSE WORLD STOCK INDEX	100 % Original Portfolio	90 % Original Portfolio / 10 % 56 PROXIES	80 % Original Portfolio / 20 % 56 PROXIES	70 % Original Portfolio / 30 % 56 PROXIES	60 % Original Portfolio / 40 % 56 PROXIES	50 % Original Portfolio / 50 % 56 PROXIES	40 % Original Portfolio / 60 % 56 PROXIES
Return	4.56 %	8.69 %	8.15 %	9.48 %	10.30 %	14.19 %	13.42 %	8.60 %
Yield	2.46 %	2.46 %	3.17 %	3.11 %	2.82 %	2.82 %	3.02 %	3.15 %
Sharpe Ratios	0.20	0.35	0.33	0.39	0.41	0.59	0.56	0.35

Risk Statistics								
Indices and Portfolios	FTSE WORLD STOCK INDEX	100 % Original Portfolio	90 % Original Portfolio / 10 % 56 PROXIES	80 % Original Portfolio / 20 % 56 PROXIES	70 % Original Portfolio / 30 % 56 PROXIES	60 % Original Portfolio / 40 % 56 PROXIES	50 % Original Portfolio / 50 % 56 PROXIES	40 % Original Portfolio / 60 % 56 PROXIES
Standard Deviation	23.22 %	24.86 %	24.82 %	24.35 %	24.89 %	24.23 %	24.02 %	24.75 %
Semi Deviation	17.24 %	18.04 %	18.11 %	17.77 %	18.27 %	17.61 %	17.47 %	18.17 %
MaxDrawDown	34.24 %	34.61 %	35.31 %	35.14 %	36.53 %	34.04 %	33.61 %	34.97 %
Ulcer	10.27 %	10.08 %	9.96 %	9.22 %	9.65 %	8.65 %	9.39 %	10.14 %

Benchmark Data								
Indices and Portfolios	FTSE WORLD STOCK INDEX	100 % Original Portfolio	90 % Original Portfolio / 10 % 56 PROXIES	80 % Original Portfolio / 20 % 56 PROXIES	70 % Original Portfolio / 30 % 56 PROXIES	60 % Original Portfolio / 40 % 56 PROXIES	50 % Original Portfolio / 50 % 56 PROXIES	40 % Original Portfolio / 60 % 56 PROXIES
R-square	0.54	0.46	0.46	0.44	0.43	0.36	0.42	0.43
Beta	1.00	1.12	1.06	1.10	1.19	1.47	1.50	1.12
Alpha	0.02 %	16.10 %	15.36 %	19.58 %	20.97 %	32.65 %	29.00 %	16.18 %
Up Capture	100.00 %	103.51 %	101.46 %	98.87 %	104.32 %	105.87 %	104.91 %	102.60 %
Down Capture	100.00 %	98.95 %	98.47 %	97.05 %	98.55 %	97.37 %	97.39 %	98.65 %

# Portfolios & Benchmark

## Comparative Diversification Metrics

Diversification Measurements								
Quantitative Diversification Metrics								
Indices and Portfolios	FTSE WORLD STOCK INDEX	100 % Original Portfolio	90 % Original Portfolio / 10 % 56 PROXIES	80 % Original Portfolio / 20 % 56 PROXIES	70 % Original Portfolio / 30 % 56 PROXIES	60 % Original Portfolio / 40 % 56 PROXIES	50 % Original Portfolio / 50 % 56 PROXIES	40 % Original Portfolio / 60 % 56 PROXIES
Total Number of Portfolio Holdings	1	11	16	20	23	25	27	26
Idiosyncratic Concentration Coefficient	1.0	8.0	9.7	11.8	14.4	16.6	19.6	20.7
Fiduciary Diversification Score	1.0	5.7	7.6	9.7	11.2	12.2	13.9	14.0
Qualitative Diversification Metrics								
Sum of Weighted Position Variances	5.39 %	8.11 %	9.70 %	9.06 %	11.08 %	12.61 %	12.24 %	11.16 %
Portfolio Variance	5.39 %	6.18 %	6.16 %	5.93 %	6.20 %	5.87 %	5.77 %	6.13 %
Variance Gap	0.00 %	1.93 %	3.53 %	3.13 %	4.88 %	6.73 %	6.47 %	5.03 %
Estimated Diversification "Alpha"	0 bps	96.5 bps	176.7 bps	156.5 bps	244.0 bps	336.7 bps	323.6 bps	251.5 bps
Diversifiable Risk Remaining in Portfolio								
Quantitatively - Based on Fiduciary Scores	100 %	81 %	75 %	68 %	63 %	59 %	54 %	53 %
Qualitatively - Based on Variance Gaps	100 %	65 %	36 %	43 %	11 %	-28 %	-18 %	8 %

# 60% - 40% Portfolio Analysis

This is the starting point where in this case the user can confidently build and implement his/her own customized risk return tradeoff solution and document the prudent process that was followed.

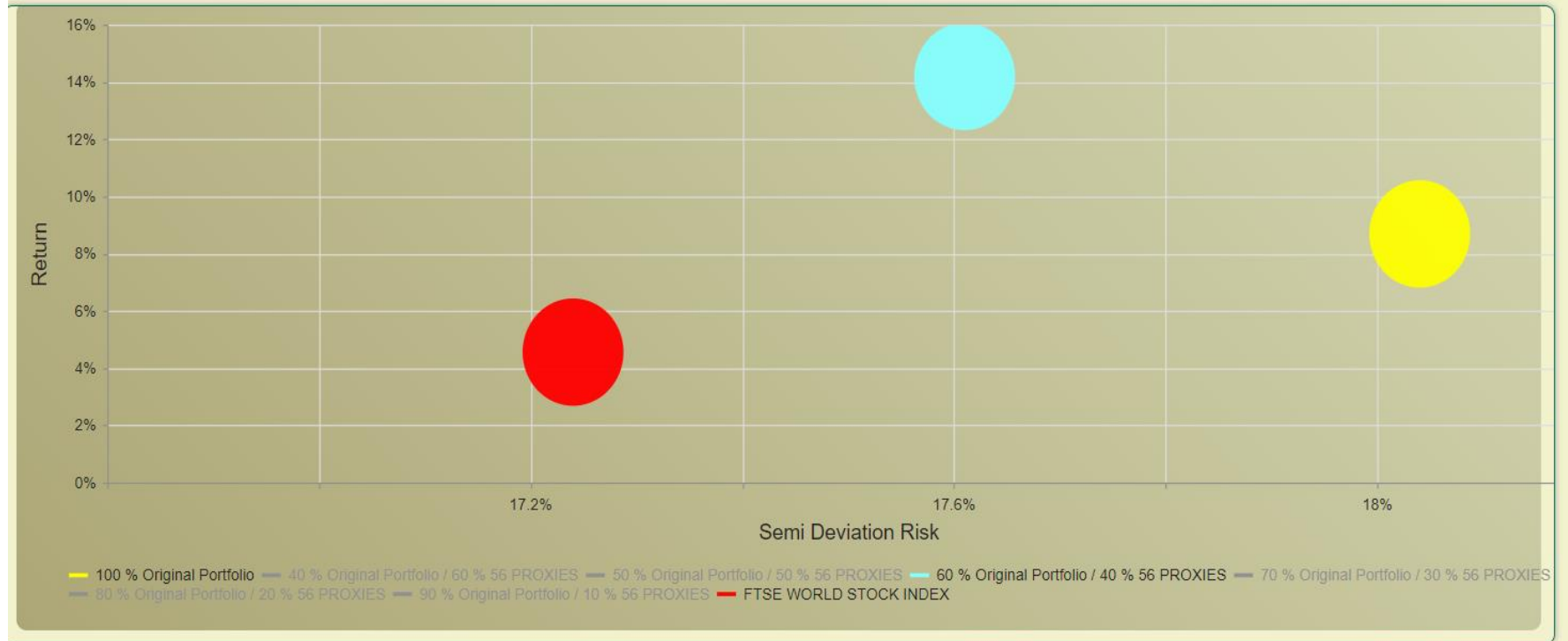
This 60-40 diversification re-optimized portfolio produced an annual ROR of 14.2% compared to 8.7% for legacy portfolio and 4.6% for the benchmark FTSE.

Note – Where Financial Plan, Investment Policy Statement, Trust Document, restrictions, etc. limit the fiduciary's ability to invest in certain securities, the fiduciary should document those restrictions.

On page 11 note the comparison during the pandemic when the 'markets' in June 2020 made up for the drop from February to March 2020. This differential for diversified portfolio is typical on significant declines and corrections.

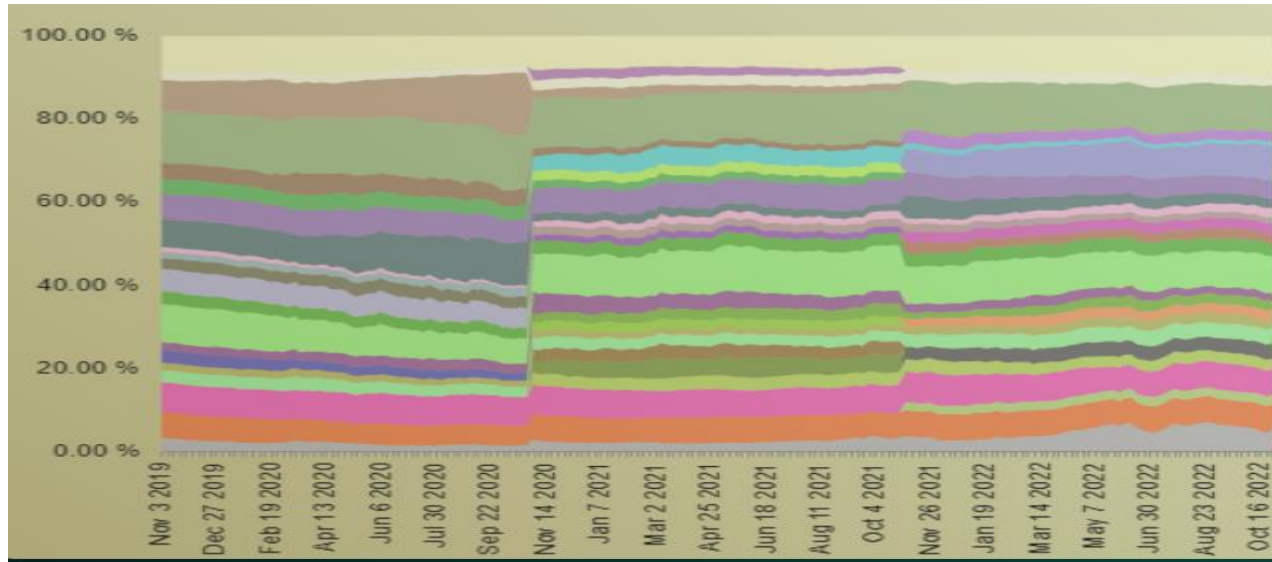
# Portfolio Risk/Reward Scatter Chart

RISK OF LOSS VS RETURNS SCATTER





## 60%-40% Portfolio Rolling Allocation Chart



On each of the three annual anniversary dates (of portfolio input) the system rebalances the portfolio's initial legacy weightings to their originally entered percentages reduced to the total percentage allocated to the portfolio's legacy portion, and concurrently fills the non-legacy percent with assets optimized for best fit diversification outcomes from the list of 56 INSTITUTE'S PROXY ETFs.

The above chart graphically illustrates the combined re-balancing/re-optimization of the selected portfolio, and the following page presents the value changes resulting from the re-balancing/re-optimization activity. Forward Forecasting of the recommended [Institute's proxy funds](#) is done by the algorithm, based only on information available before the date of each forecast.

# 60%-40% Portfolio

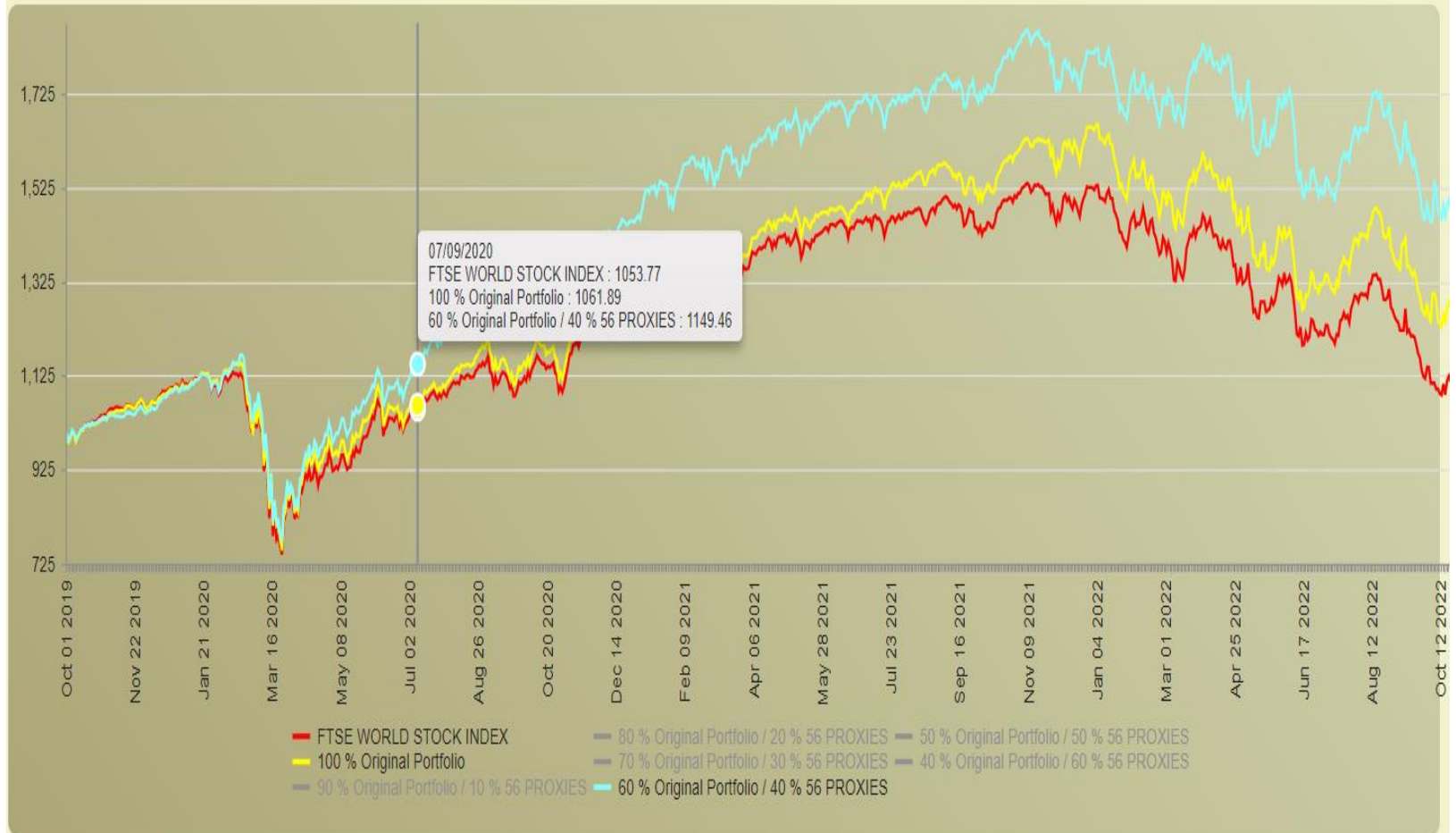
## Rolling Value Table

Symbol	11/03/2019	10/28/2020	11/02/2020	10/28/2021	11/02/2021	10/28/2022	10/29/2022
XLY	46,748	56,492	58,245	81,679	85,407	61,842	72,000
XLF	58,998	48,647	75,616	128,017	107,561	89,163	90,000
IYR	15,387	13,069	20,243	28,835	28,392	21,593	24,000
XLC	39,340	45,520	49,317	67,179	65,837	42,714	60,000
XLE	7,963	3,946	10,495	21,406	14,465	22,577	12,000
XLP	19,195	20,363	24,773	28,682	36,038	36,293	30,000
XLI	39,661	37,368	50,953	69,243	72,572	63,623	60,000
XLU	11,582	11,901	14,910	16,240	21,436	21,215	18,000
XLV	54,252	60,221	69,184	89,936	101,496	99,147	84,000
XLB	19,545	20,816	25,799	34,412	35,989	31,177	30,000
XLK	79,064	104,988	97,593	142,372	138,904	110,355	120,000
BETZ	0	0	28,662	44,545	17,623	8,491	20,000
DBA	0	0	20,358	26,985	0	0	25,000
EWV	0	0	0	0	35,116	36,352	15,000
GLD	26,115	32,358	16,485	15,574	0	0	25,000
ICLN	9,475	17,433	0	0	0	0	20,000
IGE	0	0	0	0	66,045	84,843	25,000
IGN	0	0	12,311	18,411	0	0	35,000
IHI	22,576	27,500	16,308	21,089	0	0	25,000
LIT	0	0	0	0	0	0	25,000
OIH	0	0	22,720	49,385	0	0	75,000
PPH	0	0	0	0	0	0	15,000
QCLN	0	0	0	0	31,305	21,804	20,000
TAN	49,025	122,282	16,778	23,181	0	0	15,000
UNG	20,750	11,610	24,067	37,878	42,773	46,442	60,000
EWC	0	0	0	0	29,900	24,968	0
EZA	19,275	15,641	0	0	0	0	0
GDX	13,030	17,417	43,156	36,599	23,290	18,346	0
IBUY	44,432	86,709	15,591	19,278	64,295	23,712	0
IGV	0	0	15,883	22,861	23,585	14,377	0
KBE	0	0	21,675	36,259	0	0	0
KIE	0	0	0	0	24,012	23,311	0
MCHI	0	0	20,781	18,701	0	0	0
PHO	35,429	39,314	0	0	0	0	0
SLX	0	0	0	0	23,324	24,258	0
SMH	0	0	16,570	25,822	0	0	0
USO	0	0	16,289	35,604	18,555	22,774	0
XBI	16,284	22,388	0	0	0	0	0
XHB	0	0	25,024	36,494	35,384	26,581	0
XRT	0	0	0	0	37,004	24,043	0
<b>Total</b>	<b>648,128</b>	<b>815,982</b>	<b>829,786</b>	<b>1,176,666</b>	<b>1,180,306</b>	<b>1,000,000</b>	<b>1,000,000</b>

# Portfolio Comparative P & L Chart



## PROFIT AND LOSS



# 3-Year Trailing Correlation Matrix of 60% - 40% (Forward Looking Constituents)



Symbol	XLY	XLF	IYR	XLC	XLE	XLP	XLI	XLU	XLV	XLB	XLK	BETZ	DBA	EWV	GLD	ICLN	IGE	IGN	IHI	LIT	OIH	PPH	QCLN	TAN	UNG
XLY	1	0.76	0.74	0.85	0.53	0.66	0.80	0.58	0.72	0.79	0.88	0.60	0.25	0.67	0.14	0.71	0.59	0.80	0.77	0.69	0.48	0.69	0.79	0.65	0.13
XLF	0.76	1	0.80	0.70	0.76	0.72	0.92	0.67	0.74	0.89	0.72	0.41	0.28	0.75	0.04	0.59	0.78	0.73	0.72	0.61	0.70	0.75	0.60	0.49	0.13
IYR	0.74	0.80	1	0.68	0.58	0.75	0.83	0.80	0.76	0.79	0.72	0.36	0.23	0.70	0.17	0.60	0.63	0.71	0.76	0.56	0.50	0.75	0.58	0.50	0.10
XLC	0.85	0.70	0.68	1	0.48	0.66	0.71	0.55	0.72	0.72	0.89	0.55	0.25	0.61	0.15	0.61	0.55	0.74	0.75	0.60	0.43	0.70	0.66	0.55	0.13
XLE	0.53	0.76	0.58	0.48	1	0.48	0.74	0.46	0.52	0.72	0.49	0.29	0.36	0.64	0.12	0.49	0.96	0.56	0.47	0.52	0.93	0.56	0.49	0.41	0.15
XLP	0.66	0.72	0.75	0.66	0.48	1	0.76	0.81	0.81	0.73	0.71	0.26	0.17	0.58	0.17	0.44	0.54	0.63	0.72	0.44	0.39	0.78	0.41	0.34	0.10
XLI	0.80	0.92	0.83	0.71	0.74	0.76	1	0.72	0.78	0.92	0.76	0.43	0.30	0.76	0.12	0.64	0.78	0.78	0.77	0.64	0.68	0.77	0.65	0.54	0.12
XLU	0.58	0.67	0.80	0.55	0.46	0.81	0.72	1	0.75	0.69	0.60	0.18	0.15	0.58	0.23	0.50	0.51	0.56	0.69	0.42	0.36	0.69	0.41	0.39	0.09
XLV	0.72	0.74	0.76	0.72	0.52	0.81	0.78	0.75	1	0.77	0.80	0.37	0.19	0.63	0.15	0.56	0.57	0.71	0.92	0.55	0.42	0.92	0.53	0.46	0.13
XLB	0.79	0.89	0.79	0.72	0.72	0.73	0.92	0.69	0.77	1	0.76	0.47	0.33	0.76	0.19	0.66	0.79	0.78	0.76	0.67	0.66	0.77	0.67	0.56	0.14
XLK	0.88	0.72	0.72	0.89	0.49	0.71	0.76	0.60	0.80	0.76	1	0.53	0.23	0.63	0.16	0.69	0.56	0.82	0.83	0.68	0.43	0.74	0.74	0.63	0.14
BETZ	0.60	0.41	0.36	0.55	0.29	0.26	0.43	0.18	0.37	0.47	0.53	1	0.16	0.41	0.14	0.53	0.35	0.53	0.49	0.48	0.30	0.36	0.60	0.50	0.03
DBA	0.25	0.28	0.23	0.25	0.36	0.17	0.30	0.15	0.19	0.33	0.23	0.16	1	0.29	0.20	0.25	0.39	0.23	0.19	0.25	0.37	0.21	0.25	0.23	0.14
EWV	0.67	0.75	0.70	0.61	0.64	0.58	0.76	0.58	0.63	0.76	0.63	0.41	0.29	1	0.14	0.60	0.67	0.65	0.61	0.61	0.59	0.64	0.58	0.51	0.11
GLD	0.14	0.04	0.17	0.15	0.12	0.17	0.12	0.23	0.15	0.19	0.16	0.14	0.20	0.14	1	0.22	0.23	0.16	0.16	0.20	0.11	0.16	0.17	0.20	0.03
ICLN	0.71	0.59	0.60	0.61	0.49	0.44	0.64	0.50	0.56	0.66	0.69	0.53	0.25	0.60	0.22	1	0.56	0.68	0.64	0.71	0.47	0.56	0.91	0.95	0.09
IGE	0.59	0.78	0.63	0.55	0.96	0.54	0.78	0.51	0.57	0.79	0.56	0.35	0.39	0.67	0.23	0.56	1	0.64	0.54	0.57	0.90	0.63	0.56	0.47	0.16
IGN	0.80	0.73	0.71	0.74	0.56	0.63	0.78	0.56	0.71	0.78	0.82	0.53	0.23	0.65	0.16	0.68	0.64	1	0.75	0.63	0.54	0.70	0.74	0.62	0.12
IHI	0.77	0.72	0.76	0.75	0.47	0.72	0.77	0.69	0.92	0.76	0.83	0.49	0.19	0.61	0.16	0.64	0.54	0.75	1	0.61	0.40	0.81	0.64	0.56	0.13
LIT	0.69	0.61	0.56	0.60	0.52	0.44	0.64	0.42	0.55	0.67	0.68	0.48	0.25	0.61	0.20	0.71	0.57	0.63	0.61	1	0.49	0.56	0.77	0.70	0.14
OIH	0.48	0.70	0.50	0.43	0.93	0.39	0.68	0.36	0.42	0.66	0.43	0.30	0.37	0.59	0.11	0.47	0.90	0.54	0.40	0.49	1	0.49	0.48	0.40	0.12
PPH	0.69	0.75	0.75	0.70	0.56	0.78	0.77	0.69	0.92	0.77	0.74	0.36	0.21	0.64	0.16	0.56	0.63	0.70	0.81	0.56	0.49	1	0.54	0.47	0.13
QCLN	0.79	0.60	0.58	0.66	0.49	0.41	0.65	0.41	0.53	0.67	0.74	0.60	0.25	0.58	0.17	0.91	0.56	0.74	0.64	0.77	0.48	0.54	1	0.91	0.11
TAN	0.65	0.49	0.50	0.55	0.41	0.34	0.54	0.39	0.46	0.56	0.63	0.50	0.23	0.51	0.20	0.95	0.47	0.62	0.56	0.70	0.40	0.47	0.91	1	0.07
UNG	0.13	0.13	0.10	0.13	0.15	0.10	0.12	0.09	0.13	0.14	0.14	0.03	0.14	0.11	0.03	0.09	0.16	0.12	0.13	0.14	0.12	0.13	0.11	0.07	1

Visually this matrix shows the importance of identifying non-correlation of price movements between different securities. It is the most important part of Diversification.

Note that the legacy portfolio comprises the first 11 constituents and contains moderately correlated holdings.

The system improved diversification by replacing the legacy's overall weighting with a number of less correlated assets having favorable Sharpe Ratio momentum.

The following slide provides additional information that allows the user to easily customize portfolios.

## 60% - 40% Portfolio

### Table of Correlation Scores, Allocations, & Sharpe Ratios

#	Symbol	Red	Orange	Yellow	Score	Sharpe	%
1	XLY	0	8	7	15	0.25	7.2%
2	XLF	3	4	12	19	0.22	9.0%
3	IYR	0	6	9	15	(0.06)	2.4%
4	XLC	0	4	7	11	(0.03)	6.0%
5	XLE	6	0	3	9	0.48	1.2%
6	XLP	0	4	7	11	0.41	3.0%
7	XLI	6	4	11	21	0.26	6.0%
8	XLU	0	4	2	6	0.16	1.8%
9	XLV	6	4	8	18	0.61	8.4%
10	XLB	3	2	12	17	0.36	3.0%
11	XLK	0	10	7	17	0.49	12.0%
12	BETZ	0	0	0	0	(0.12)	2.0%
13	DBA	0	0	0	0	0.54	2.5%
14	EWV	0	0	4	4	0.15	1.5%
15	GLD	0	0	0	0	0.21	2.5%
16	ICLN	6	0	2	8	0.57	2.0%
17	IGE	6	0	3	9	0.47	2.5%
18	IGN	0	4	9	13	0.40	3.5%
19	IHI	3	4	8	15	0.25	2.5%
20	LIT	0	0	3	3	1.04	2.5%
21	OIH	6	0	1	7	0.15	7.5%
22	PPH	3	2	8	13	0.40	1.5%
23	QCLN	6	0	4	10	0.80	2.0%
24	TAN	6	0	1	7	0.71	1.5%
25	UNG	0	0	0	0	(0.05)	6.0%

Look at this table as an Artificial Intelligent Assistant suggesting a course of action and enhancing your ability to customize. Look for a high total score legacy (too correlated) with a low Sharpe Ratio (less return or more risk). These are the “bad apples” to reduce first in the legacy portfolio. One might consider more reduction in XLF IYR XLI first, and the balance spread between the remaining legacy ETFs. This could increase the 60-40 ROR by 20+- basis points depending upon the final choices and changes.

Because this table uses 3-year trailing data from a forward-looking portfolio’s model of potential future constituents, shorter periods of analysis may also be needed to better customize diversification, a process that is easily accomplished on the “Toolbox” platform.

Omitted from this analysis is when to re-establish the compensated risk element to the portfolio by re- introducing a fixed income portion. Expect no large benefit from reducing **uncompensated** risk since these mixed portfolios replace the risk asset **compensated** risk with fixed income **compensated** risk (which has its own unique risks added).

## APPENDIX OF FURTHER RESOURCES

***“One of the central findings of Modern Portfolio Theory is huge and essentially costless gains can be obtained from diversifying a portfolio thoroughly by minimizing Uncompensated Risk.”***

- John H. Langbein, Reporter Uniform Prudent Investor Act

**RESTATEMENT OF TRUSTS, 3<sup>RD</sup> CONCLUSIVELY SAYS:** “Failure to diversify on a reasonable basis to reduce uncompensated risk is ordinarily a violation of the duties of caution, care and skill.”

Passing on A ‘Free Lunch’ Is Not “Acting with Care-Skill-Prudence & Diligence”

<https://lnkd.in/geB-aTfk/>

**THE 3<sup>rd</sup> RESTATEMENT TRUSTS RAISES 2 ESSENTIAL QUESTIONS:**

What constitutes “Failure to diversify on a reasonable basis”? & How is Uncompensated Risk determined? For the answer go to <https://lnkd.in/eNBKaVPJ/>

**“THE ONLY FREE LUNCH IN INVESTING!!”** Nobel Prize Markowitz, Fama, Sharpe

The Proof is in the Pudding! <https://lnkd.in/ge7MNkYU/>

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