

# Construction and Analysis of the Pathway to FI Model Portfolios

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**Contents**

- 1.0 Introduction ..... 3
- 2.0 Portfolios..... 3
  - 2.1. Reference Portfolios ..... 3
  - 2.2. Pathway to FI Model Portfolios ..... 4
- 3.0 Performance Analysis..... 5
  - 3.1. Portfolio Performance since 1970 ..... 5
  - 3.2. The Case for Utilities ..... 8
- 4.0 Conclusion..... 11
- 5.0 Appendix ..... 13
  - 5.1. Individual Asset Class Analysis ..... 13
    - 5.1.1. Asset Class Correlation..... 13
    - 5.1.2. Individual Asset Class Performance ..... 16
  - 5.2. Metrics Definitions..... 20

## 1.0 Introduction

Three model portfolios were constructed for PathwayToFI.com, seeking to provide readers with a model for asset allocation at each [stage](#) of their financial journey that suits them well based on the available historical data and improves upon conventional age-based stock/bond portfolios in most of the literature today. The risk parity principle of balancing risk across uncorrelated assets was used in this process. Only the Descent portfolio would be considered a true risk parity portfolio, however, since it has more balanced percentages across several categories of stocks, bonds, and gold.

The performance of these portfolios was analyzed against several common portfolios recommended by the media and main-stream financial advisors. This paper will show that the Pathway to FI model portfolios are superior for the intended purpose of their corresponding financial stages based on the available historical data.

The primary criteria at early financial stages, prior to Financial Independence (FI), were to maintain high growth as compared to a 100% Total US Stock Market portfolio while reducing overall volatility and the worst case losses a portfolio could experience. At later stages, post-FI, volatility and worst case losses were further reduced, adding a focus on increasing Safe Withdrawal Rate (SWR) and Perpetual Withdrawal Rate (PWR) and reducing the time that the portfolio takes to recover from a loss compared to a range of common stock/bond allocations. It is the author's opinion that these portfolios are better than conventional stock/bond portfolios in all cases and well-suited for those considering risk parity portfolios as well given that the corresponding risks are accepted along with the potential for higher long-term gains.

## 2.0 Portfolios

### 2.1. Reference Portfolios

To provide a baseline for comparison, we first look at the performance of several conventional portfolios and a more diversified risk parity portfolio called the Golden Butterfly, which are allocated per Figure 1.

	Total Stock Market	Small Cap Value	Long- Term Bonds	Intermed- iate Term Bonds	Short- Term Bonds	Gold
Total Stock Market	100					
80/20	80			20		
60/40	60			40		
Golden Butterfly	20	20	20		20	20

Figure 1 – Reference Portfolio Composition

The Total Stock Market (TSM) portfolio is popular in the Financial Independence Retire Early (FIRE) community, and is most comparable with the Trailhead/Ascent all stock portfolio in Figure 2. The 80/20 and 60/40 portfolios are popular in mainstream media, and can be compared to the Summit and

Descent portfolios respectively. Risk parity is gaining popularity as an alternative approach for low volatility during retirement, so the Golden Butterfly will also be compared to the Descent portfolio.

## 2.2. Pathway to FI Model Portfolios

The Pathway to FI is broken up into 4 stages: Trailhead, Ascent, Summit, and Descent. These are described in detail at [www.pathwaytofi.com/starthere](http://www.pathwaytofi.com/starthere). Briefly, Stage 1-Trailhead is the beginning of a person’s financial journey, Stage 2-Ascent is the primary savings and wealth building period, Stage 3-Summit spans the attainment of FI until one ceases to work for money, and Stage 4-Descent is the period where investments are withdrawn and relied upon as income.

Stages 1 and 2 are both focused on building wealth quickly and with high certainty and only differ in the amounts invested and being added on a recurring basis. Because of this, they can share a single portfolio as shown in Figure 2 below.

This portfolio contains 5 asset classes, and is weighted most heavily toward large cap blend and then small cap value US stocks. A good portion of international stocks are added for some country, currency, and additional sector (industry) diversification. Finally, small portions of real estate and utilities are included. These are the two most valuable sectors for high, yet uncorrelated returns relative to the broader market indices, and are under-represented in capitalization-weighted indices such as the S&P 500. Notice that despite the diversification this portfolio is 100% stocks.

		Large Cap Blend	Small Cap Value	Inter-national	Real Estate	Utilities	Long Term Bonds	Gold
Stage 1/2	Trailhead/Ascent	35	30	25	5	5		
Stage 3	Summit	25	25	20	5	5	10	10
Stage 4	Descent	20	20	10	10	10	15	15

Figure 2– Pathway to FI Model Portfolios

The Stage 3 portfolio takes some risk off the table to smooth the ride and position the portfolio for near-term withdrawals if the investor so chooses. To do this, it adds long-term bonds and gold. Using long-term rather than short- or intermediate-term bonds allows for a smaller position to have a greater impact on the overall portfolio because of its higher sensitivity to interest rate changes, and therefore leaves more room in the portfolio for stocks. Gold has a surprisingly large and positive impact on a portfolio based on the research presented here, and a 10-15% exposure benefits from its risk-reducing and SWR-enhancing behavior without losing too much of the upside potential that stocks provide. Broadly speaking, this portfolio is still 80% stocks and 20% bonds/gold.

The Stage 4 portfolio continues to de-risk the investor by shifting 20 more percentage points from broad US and international stocks into real estate, utilities, long-term bonds, and gold. This may provide more opportunities for rebalancing and withdrawals from the outperforming asset class at any given time since 5% positions in any one asset class are minimally effective at those activities. The general composition of this portfolio is 70% stocks and 30% bonds/gold.

### 3.0 Performance Analysis

The historical performance of each model portfolio in Figure 2 was analyzed using two tools:

1. [Portfolio Charts](#) calculates many useful metrics with data consolidated from numerous [sources](#) and going back to 1970. The data covers all asset classes used in the model portfolios except utilities. Real Estate Investment Trusts (REITs) were substituted in this case due to having low, but closest correlation and similar long-term average returns as can be seen in section 5.1.
2. [Portfolio Visualizer](#) has data for almost every mutual fund and Exchange Traded Fund (ETF), which are used to fill in the gap for utilities analysis and provide a secondary assessment.

#### 3.1. Portfolio Performance since 1970

A myriad of metrics could be used to make a comparison with the reference portfolios. At a minimum, this should include an average return, volatility measure, worst and best case long-term return, and a measure of the ability for the portfolio to last during retirement withdrawals. Figure 3 presents the performance of each portfolio—color coded for easy comparison—across the metrics that were chosen and compiled from Portfolio Charts. Refer to the Appendix for definitions of each metric.

		Average Annual Return (%)	Std. Dev. (%)	Loss Freq. (%)	Deepest Draw-down (%)	Longest Time to Recover (yrs)	Ulcer Index	Worst 10-year Return (%)	Median 10-year Return (%)	Best 10-year Return (%)	30-year SWR (%)	40+ year PWR (%)
S1/2 Ref	Tot. Stock Market	8.4	16.4	31	51	13	16.7	-3	8.2	14.5	4.3	3.4
S3 Ref	80/20	7.2	13.8	31	44	12	13.1	-1.3	7.1	12.9	4.4	3.5
S4 Ref	60/40	6.1	11	27	37	12	10.4	-1.8	6.1	11.2	4.4	3.4
S4 Ref	Golden Butterfly	6.3	7.8	17	10	3	2.5	4.2	6.1	8.4	6.3	5.1
Stage 1/2	Trailhead/Ascent	8.7	15.7	25	47	9	12.4	0	9.1	13.6	5.5	4.7
Stage 3	Summit	8	12.3	25	32	5	7.7	2.4	7.8	11.4	6.2	5.3
Stage 4	Descent	7.9	10.8	23	24	5	5.7	3.8	7.4	10.5	6.5	5.6

Figure 3 – Performance Metrics and Portfolio Comparisons using Portfolio Charts

To further visualize these results, the following three figures plot Average Annual Return, Safe Withdrawal Rate (SWR), and Perpetual Withdrawal Rate (PWR) against Ulcer Index.

The Return versus Risk plot of Figure 4 is in the vein of Henry Markowitz’s famous Modern Portfolio Theory (MPT), which discusses tradeoffs between return and risk and has been used for decades to explain that an asset should only be included in a portfolio if its increased return does not add undue risk or, vice versa, if the risk reduction it provides is accompanied by a much larger relative drop in return. The cornerstone of MPT is known as the efficient frontier, which describes the set of portfolios that offer the highest return for a given level of risk. If any portfolio can be found to both reduce risk *and* increase returns, it is seen as a more “efficient” portfolio. As shown by the dotted lines in Figure 4, the Total Stock Market, 80/20, and 60/40 portfolios are less efficient than their Pathway to FI counterparts, which improve on both risk and return. The same would be seen if standard deviation were used as the risk measure rather than the Ulcer Index and if Median 10-year Return were used instead of Average Annual Return. Therefore, according to MPT the Pathway to FI portfolios are superior to these reference portfolios. The Golden Butterfly portfolio, on the other hand, provides a lower return in exchange for lower risk, making it efficient as well.

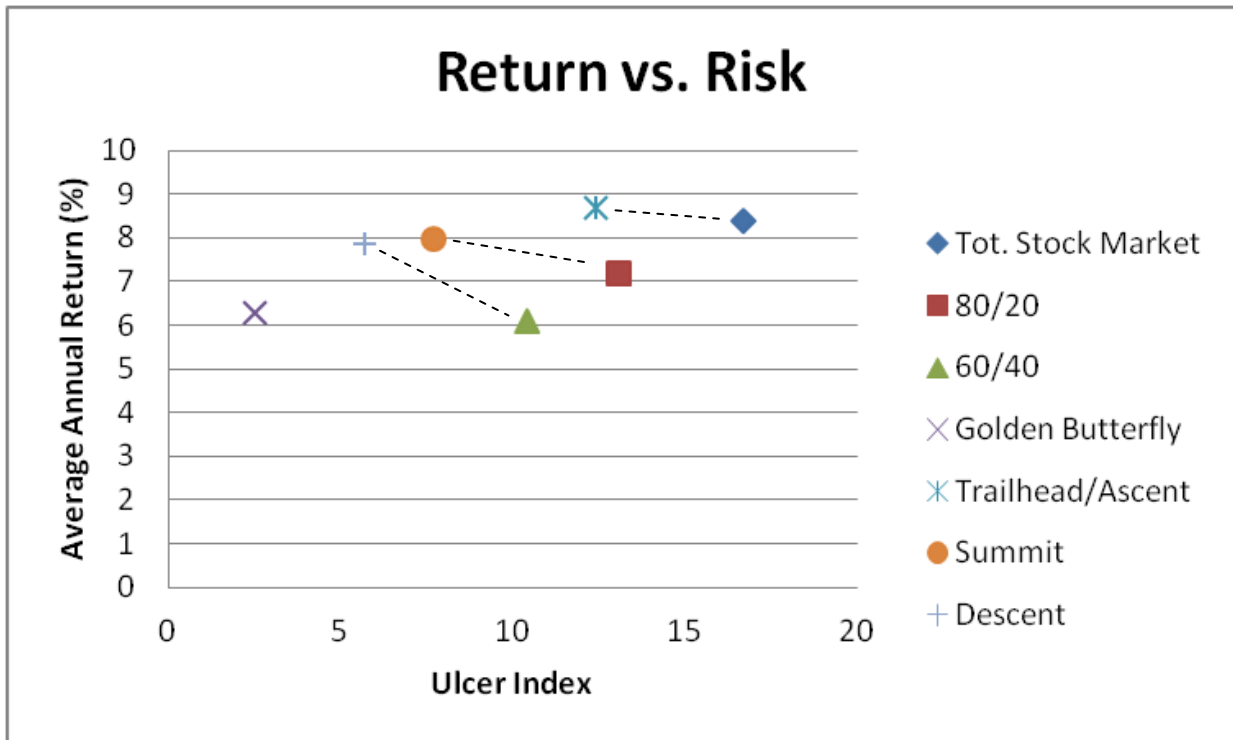


Figure 4 – Average Annual Return versus Ulcer Index for Model and Reference Portfolios

The SWR versus Risk plot of Figure 5 shows similar relationships between portfolios as the previous plot. The 4% Rule for retirement withdrawals was coined in the 90s by Bill Bengen and remains a hot topic today. It was derived using a 50/50 portfolio, which would fall just to the left of the 60/40 mark at an Ulcer Index of 9.6 and SWR of 4.4. Interestingly, the reference portfolios all hover slightly above the 4% line, showing why many have marveled at this “magic” number. However, as Figure 5 shows, this number can be improved upon without taking on additional risk! The model portfolios all achieved an SWR of well over 5%. Even the Trailhead/Ascent portfolio, which was designed for high growth during an investor’s accumulation years, did fairly well by that measure.

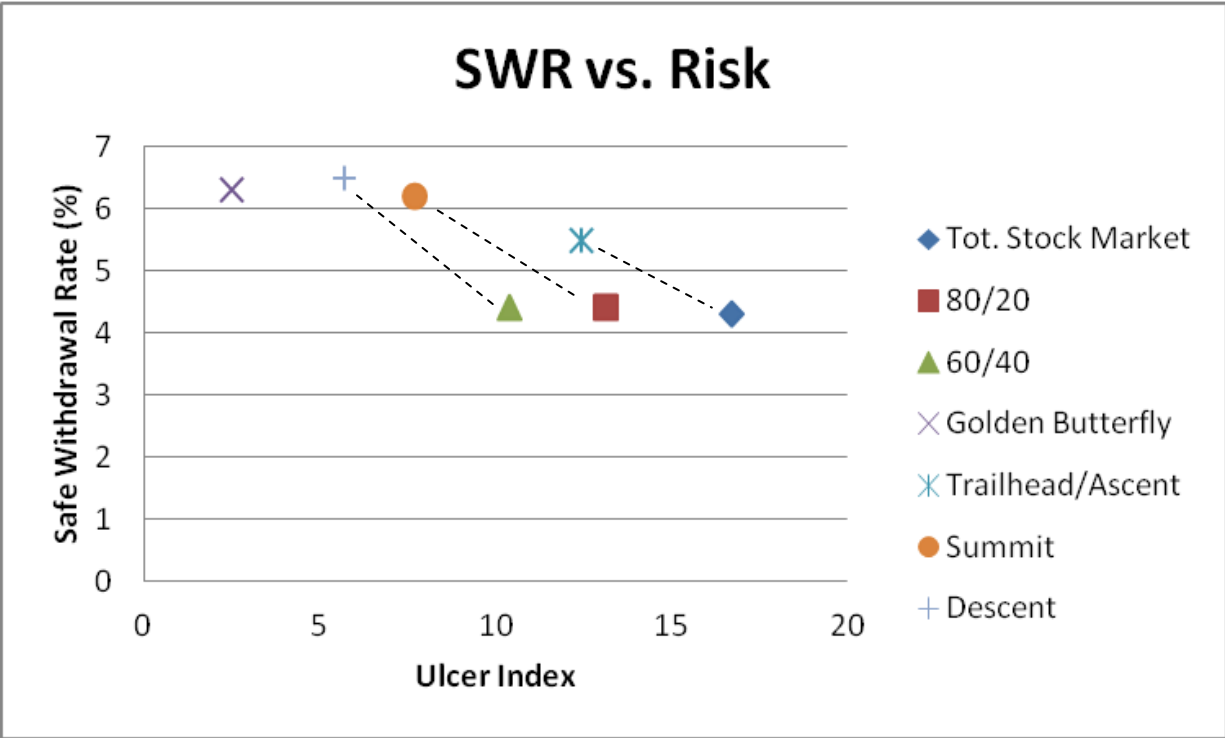


Figure 5 – SWR versus Ulcer Index for Model and Reference Portfolios

Those anticipating an early retirement and/or long life expectancy will require a longer drawdown period than the 30 year cutoff for SWR. The PWR is a better metric for this scenario, and is plotted in Figure 6. Again, the model portfolios exceed their counterparts in PWR. Descent and Summit portfolios are #1 and #2 for PWR and the Trailhead/Ascent portfolio once again performs well here despite its purpose being for significantly higher growth potential.

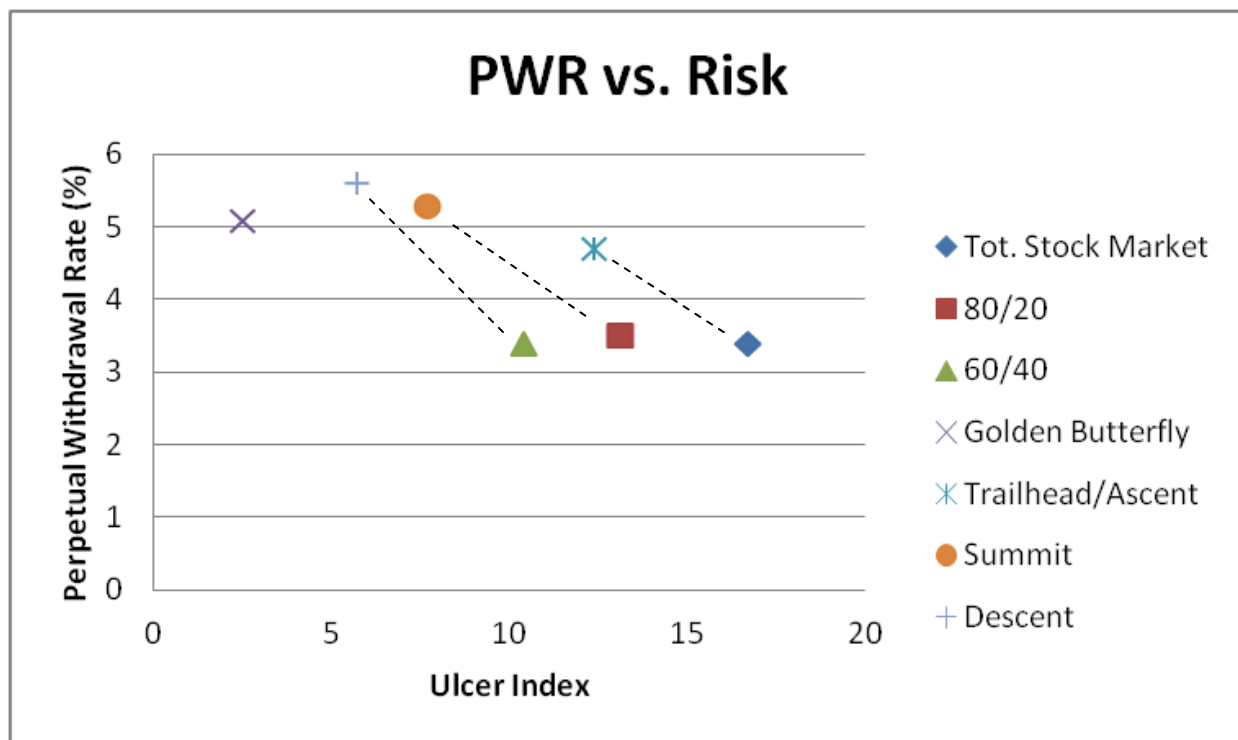


Figure 6 – PWR versus Ulcer Index for Model and Reference Portfolios

### 3.2. The Case for Utilities

At this point, the reader may be intrigued by the model portfolios but wondering why they should even bother with utilities when the above analysis substituted them with REITs and appears to perform just fine. The following discussion makes the comparison between REITs and utilities and explains some of the motivation behind using utilities in long-term buy-and-hold portfolios.

A downside of REITs is their tax status when held in a taxable brokerage account rather than a tax-advantaged retirement account such as an IRA or 401k. REITs are required to make distributions of profits in the form of unqualified dividends, which are taxed at ordinary income tax rates. Utilities also pay relatively high dividends, however these are taxed at more favorable capital gains rates if held for a long enough duration. Therefore, for tax strategy it might help to have another asset class such as utilities to hold in a brokerage account so that the entire REIT allocation can be held in retirement accounts. This typically comes into play for high savers.

Utilities have meaningfully lower correlation with broad stock indices than REITs as highlighted by the orange box in Figure 7, where VGSIX and XLU are long-running REIT and utility funds, respectively. The lower correlation provides an advantage in some market scenarios by smoothing the ride. One reason for this is that utilities are seen as a safer asset in recessionary environments because when money is tight, people will prioritize keeping their lights on and heating and cooling their homes over other discretionary products such as new cars, smart phones, and fashion. Utility companies are also highly regulated, keeping profits consistent and more predictable. Therefore, adding utilities to a portfolio can reduce risk and volatility. Asset correlation is discussed in more detail in Appendix section 5.1.1.



Name	Ticker	VFINX	DFSVX	EFA	EEM	VGSIX	XLU	TLT	GLD
Vanguard 500 Index Investor	VFINX	1.00	0.87	0.88	0.76	0.73	0.48	-0.24	0.07
DFA US Small Cap Value I	DFSVX	0.87	1.00	0.78	0.71	0.71	0.32	-0.38	0.01
iShares MSCI EAFE ETF	EFA	0.88	0.78	1.00	0.87	0.69	0.44	-0.22	0.16
iShares MSCI Emerging Markets ETF	EEM	0.76	0.71	0.87	1.00	0.60	0.37	-0.21	0.29
Vanguard Real Estate Index Investor	VGSIX	0.73	0.71	0.69	0.60	1.00	0.50	-0.00	0.11
Utilities Select Sector SPDR ETF	XLU	0.48	0.32	0.44	0.37	0.50	1.00	0.14	0.17
iShares 20+ Year Treasury Bond ETF	TLT	-0.24	-0.38	-0.22	-0.21	-0.00	0.14	1.00	0.20
SPDR Gold Shares	GLD	0.07	0.01	0.16	0.29	0.11	0.17	0.20	1.00

Figure 7 – Asset Correlation Matrix from Dec 2004 – May 2022, courtesy of [Portfolio Visualizer](#)

To put some numbers on the lower volatility and risk claim, the Portfolio Visualizer Backtest Portfolio tool was used to generate Figure 8. These numbers cannot be compared directly with Figure 3 since the data cover a much shorter duration (23 and 17 years versus 53 years) and the calculation methods may differ slightly. In fact, Loss Frequency and Ulcer Index were not provided by Portfolio Visualizer, and had to be calculated by hand using the monthly data. This figure is useful for the intent of this exercise, however—to directly compare the difference between including and excluding utilities in each model portfolio.

	Average Annual Return (%)	Std. Dev. (%)	Loss Freq. (%)	Deepest Draw-down (%)	Longest Time to Recover (yrs)	Ulcer Index	
<b>Trailhead/Ascent w/o Utilities</b>	8.1	16.5	36	55.7	5	7.4	from Jan 1999
<b>with Utilities</b>	8	16	36	54.3	5	7.4	
<b>Summit w/o Utilities</b>	9	13.5	32	43.6	3	6.2	from Dec 2004
<b>with Utilities</b>	9	13	33	42.1	3	6.1	
<b>Descent w/o Utilities</b>	9	13.1	31	42.2	3	5.9	from Dec 2004
<b>with Utilities</b>	9	12	31	39.1	3	5.8	

Figure 8 – Portfolio performance comparisons with and without Utilities

It can be concluded through Figure 8 that including utilities in the portfolios does not significantly impact their average annual returns while marginally reducing standard deviation and drawdown. Recall that

the Descent portfolio (blue) has a 10% allocation to utilities, whereas the other two portfolios only allocate 5%. This explains the larger reduction in standard deviation and max drawdown that it achieves when including utilities in the mix.

Next, Figure 9 was generated to more closely compare the two asset classes. This figure looks at a 100% REIT portfolio, a 100% utilities portfolio, and the effect of combining these into a 50/50 Utilities/REITs portfolio. Once again, note that the time frame for comparison is limited to 23 years from Jan 1999, and is less comprehensive than the Portfolio Charts data set. From Figure 9, it is concluded that REITs have a higher average annual return at the expense of a larger standard deviation, drawdown, and recovery time. In combination with utilities, a respectable annual return is achieved and the pain of drawdowns is reduced according to the Ulcer Index.

	<b>Avg. Annual Return (%)</b>	<b>St Dev (%)</b>	<b>Loss Freq. (%)</b>	<b>Deepest Drawdown (%)</b>	<b>Longest Time to Recover (yrs)</b>	<b>Ulcer Index</b>
<b>Real Estate</b>	11.8	20.4	26	68.3	5	8.58
<b>Utilities</b>	8.6	15.1	25	43.5	4	7.87
<b>50/50 Utilities/REITs</b>	10	15.1	35	52.5	4	7.15

**Figure 9 – Performance of REITs vs. Utilities since Jan 1999**

The Deepest Drawdown and Ulcer Index appear to be in conflict in Figure 9, but this can be explained using the Drawdown plot that Portfolio Visualizer provides. See Figure 10. Since this data set only goes back 23 years, the Dotcom Crash of 2001-2002 and the Great Recession of 2007-2009 have a large effect on these metrics. Although utilities have a smaller standard deviation overall, they had the largest decline in 2001-2002. Conversely, the decline of utilities was half that of REITs in 2007-2009. REITs had an almost imperceptible drawdown and quick recovery in 2002 followed by a huge drop in 2007-2009. The combined effect of these events is for the 50/50 portfolio to have a small drop and sharp recovery in 2002 that was far easier to stomach than utilities alone and a steep drop in 2007-2009 that did not spend much time below a 100% utilities portfolio. Therefore, although it reached a greater absolute drawdown in 2009, it had a smoother overall ride in the period under review. This is the impact of uncorrelated assets.

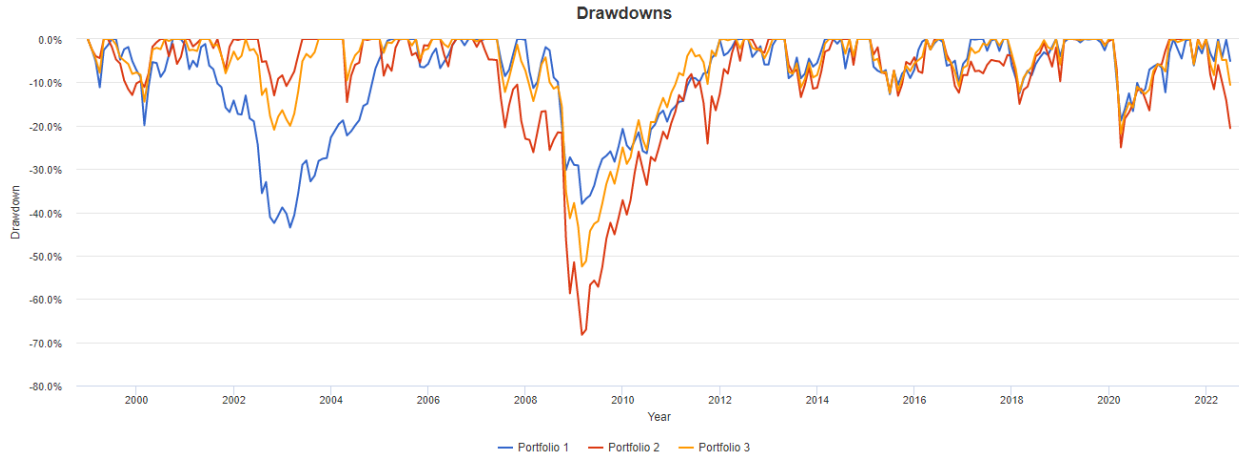


Figure 10 – Drawdowns of 100% Utilities (Portfolio 1), 100% REITs (Portfolio 2), and 50/50 Utilities/REITs (Portfolio 3)

Another interesting view provided by Portfolio Visualizer is shown in Figure 10. The black boxes were added to point out that REITs and utilities became inversely correlated when the Dotcom Crash occurred in 2001-2002 and again in 2007 when the Great Recession began. As of the middle of 2022, utilities are again holding up while REITs decline, which could indicate that this feature of inverse correlation during bear markets is continuing today, and again shows value in inclusion of utilities in a well diversified portfolio.

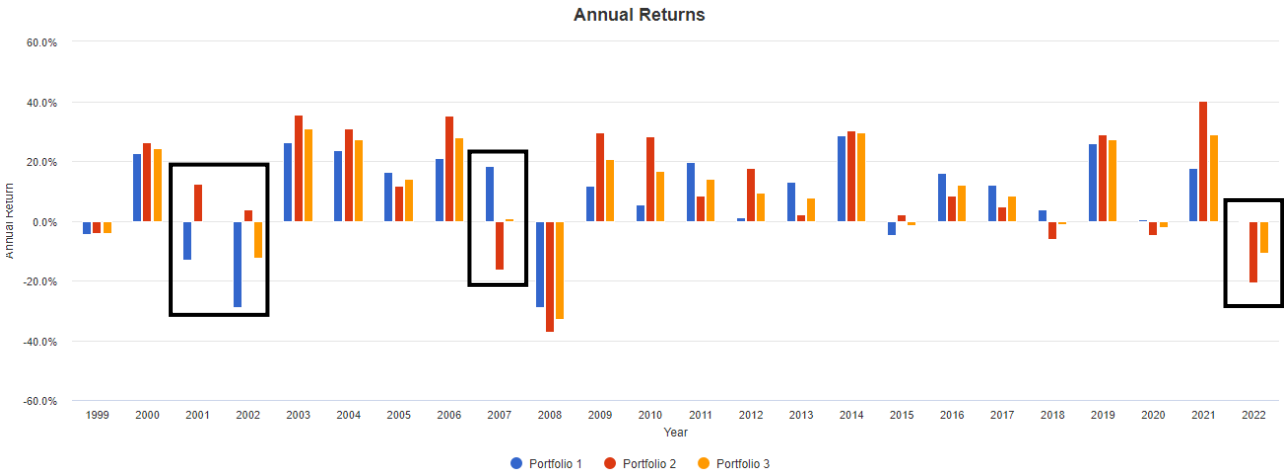


Figure 11 – Annual Returns of 100% Utilities (Portfolio 1), 100% REITs (Portfolio 2), and 50/50 Utilities/REITs (Portfolio 3)

### 4.0 Conclusion

Three model portfolios for various stages on the Pathway to FI have been presented, analyzed, and compared to three conventional portfolios and a fourth risk parity reference portfolio. It was shown that the Pathway to FI model portfolios improved both return and risk in the nearly 53 years since 1970 over the conventional portfolios and had superior return to the risk parity portfolio with what may be considered an acceptable risk premium. The utilities asset class—part of all three Pathway to FI portfolios— was not available for the 53-year period, so a 23-year span of data was used to show that

splitting a real estate position into 50/50 Utilities/REITs provided further diversification and lowered volatility and drawdown risk with minimal impact to overall portfolio returns.

## 5.0 Appendix

### 5.1. Individual Asset Class Analysis

To provide a deeper understanding of why the portfolios behave as they do, it is instructive to consider both the individual correlation and performance between the asset classes used as building blocks. It should be noted that this analysis began by including preferred stocks in addition to the asset classes presented below. Through the course of completing the analysis, it was determined that preferred stocks were not sufficiently beneficial to the model portfolios to justify including them, and they have been removed for simplicity of presentation and application.

#### 5.1.1. Asset Class Correlation

Portfolio Visualizer has a great asset correlation tool, which was used to construct the following correlation matrices. The values in each cell represent the correlation between the fund shown in the corresponding row and column, and since the rows and columns have the same funds in them the matrix is diagonally symmetrical. A low positive number means that the two assets move randomly with respect to each other, and a negative number means that the two assets tend to move in opposite directions. The diagonal cells are each fund's correlation with itself, which by definition is 1.00 (100%).

Name	Ticker	VFINX	DFSVX	EFA	EEM	VGSIX	XLU	TLT	GLD
Vanguard 500 Index Investor	VFINX	1.00	0.87	0.88	0.76	0.73	0.48	-0.24	0.07
DFA US Small Cap Value I	DFSVX	0.87	1.00	0.78	0.71	0.71	0.32	-0.38	0.01
iShares MSCI EAFE ETF	EFA	0.88	0.78	1.00	0.87	0.69	0.44	-0.22	0.16
iShares MSCI Emerging Markets ETF	EEM	0.76	0.71	0.87	1.00	0.60	0.37	-0.21	0.29
Vanguard Real Estate Index Investor	VGSIX	0.73	0.71	0.69	0.60	1.00	0.50	-0.00	0.11
Utilities Select Sector SPDR ETF	XLU	0.48	0.32	0.44	0.37	0.50	1.00	0.14	0.17
iShares 20+ Year Treasury Bond ETF	TLT	-0.24	-0.38	-0.22	-0.21	-0.00	0.14	1.00	0.20
SPDR Gold Shares	GLD	0.07	0.01	0.16	0.29	0.11	0.17	0.20	1.00

Figure 12 – Asset Correlation Matrix, courtesy of [Portfolio Visualizer](#)

To construct this matrix with the longest span of data possible, the oldest funds in each asset class were located. The data used to produce Figure 12 spans more than 17 years from Dec 2004 – May 2022, and was limited by gold. However, if the limiting fund is progressively removed, these correlations continue to hold up within reason for the remaining asset classes. Figure 13 shows this result for large cap blend, small cap value, real estate, and utilities funds, now covering more than 23 years from Jan 1999 and limited by utilities. This is an important time frame since it now encompasses the dotcom crash of 2000-

2001, where small cap value, real estate, and utilities fared better than large cap blend. Figure 13 shows the correlation between large cap blend and small cap value for more than 29 years beginning Mar 1993, the farthest back this analysis was able to go between two asset classes using these specific funds.

Name	Ticker	VFINX	DFSVX	VGSIX	XLU
Vanguard 500 Index Investor	VFINX	1.00	0.81	0.62	0.45
DFA US Small Cap Value I	DFSVX	0.81	1.00	0.66	0.30
Vanguard Real Estate Index Investor	VGSIX	0.62	0.66	1.00	0.46
Utilities Select Sector SPDR ETF	XLU	0.45	0.30	0.46	1.00

Figure 13 – Correlation Matrix for the Four Asset Classes with Longest Fund History in this Analysis (23 Years)

Name	Ticker	VFINX	DFSVX
Vanguard 500 Index Investor	VFINX	1.00	0.79
DFA US Small Cap Value I	DFSVX	0.79	1.00

Figure 14 – Correlation Matrix for the Two Asset Classes with Longest Fund History in this Analysis (29 Years)

In an attempt to look back even farther in time, two older mutual funds were found, which closely follow large cap blend and international categories and allow for the time frame to go back to Jan 1971 and now includes the high inflation period of the 1970s. FFIDX is 96% correlated with VFINX back to Sept 1971 and OPPAX is 93% correlated with EFA back to Sept 2001. Once again, there are no surprises in the correlation between these two asset classes over this longer period of time.

Name	Ticker	FFIDX	OPPAX
Fidelity	FFIDX	1.00	0.86
Invesco Global A	OPPAX	0.86	1.00

Figure 15 – Asset Correlation Matrix for Large Cap and International Funds with Data from Jan 1971 – May 2022

Returning to Figure 12, several observations can be made.

1. The asset classes are ordered in the same way as Figure 2, but two different types of international funds are being compared: EFA (developed markets outside US and Canada) and EEM (emerging markets). This is to show that emerging markets such as China, Taiwan, and India are more uncorrelated than developed markets such as the UK, EU, Japan, and Australia. An analysis was performed to consider inclusion of emerging market funds as a separate category, and results were mixed. Therefore, no distinction is made in Figure 2 between the types of international funds that would be represented, though it is assumed that at least 50% of this position would be in developed countries. It should be noted, however, that the author has chosen to hold a portion of his international stocks in emerging markets with the thesis that

the much larger population growth in those countries may result in outsized economic growth in the future.

- i. See section 5.1.2 for how developed and emerging market international stocks have performed individually. See 5.1.3 for details on how diversification within international stocks performed in the PathwayToFI portfolios.
2. The asset classes can roughly be placed into three categories, moving from left to right:
- i. **Well correlated assets.** Large cap, small cap value, and international maintain over 75% correlation with each other with just one exception—small cap value and emerging markets have a looser 71% correlation. See the blue box in Figure 2. These should be the core assets in any portfolio because of their long-term growth potential and diversification over a large number of companies and industries.
  - ii. **Loosely correlated assets.** Looking at the orange box in Figure 16, real estate and Utilities have less than 75% correlation with any other asset class, and in some cases much less. Real estate appears to be on the edge of this category with >70% correlation to large cap and small cap. However, when those asset classes are isolated to look over a longer time frame of 23 years the correlation decreases enough to be convinced that there is only a loose correlation with real estate. Figure 13 demonstrates this reduction. In fact, the correlation may be elevated in the shorter time frame because of the real estate bubble that popped in 2007-2008 and brought the rest of the market with it. The lower correlation of real estate and Utilities makes them interesting to consider adding to a stock-heavy portfolio if lower volatility is desired.
  - iii. **Uncorrelated assets.** Per the green box in Figure 16, long-term government bonds and gold are uncorrelated or, in the case of bonds, slightly negatively correlated with all other asset classes. This means that they move independently from—and sometimes in opposition to—the other assets. It is this feature that give bonds and gold value in a portfolio. They are not likely to keep up with stocks over the long term, but can be used to reduce the depths of losses in a down market. In the appropriate balance, this can be done without too much sacrifice to the expected long-term return. Both of these assets are seen as safe havens when markets are declining, and many investors put their money in bonds and gold during economic recessions.

Name	Ticker	VFINX	DFSVX	EFA	EEM	VGSIX	XLU	TLT	GLD
Vanguard 500 Index Investor	VFINX	1.00	0.87	0.88	0.76	0.73	0.48	-0.24	0.07
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Vanguard Real Estate Index Investor	VGSIX	0.73	0.71	0.69	0.60	1.00	0.50	-0.00	0.11
Utilities Select Sector SPDR ETF	XLU	0.48	0.32	0.44	0.37	0.50	1.00	0.14	0.17
iShares 20+ Year Treasury Bond ETF	TLT	-0.24	-0.38	-0.22	-0.21	-0.00	0.14	1.00	0.20
SPDR Gold Shares	GLD	0.07	0.01	0.16	0.29	0.11	0.17	0.20	1.00

Figure 16 – Asset Correlation Matrix Highlighting Categories and Observations

### 5.1.2. Individual Asset Class Performance

In isolation, few asset classes have favorable performance; most look risky. Figure 17 compares each asset class using the same metrics and Portfolio Charts data set as seen in section 5 with the exception of utilities, which were compared apples-to-apples with REITs in section 3.2 using Portfolio Visualizer data. Refer to Appendix section 5.2 for metrics definitions.

	Avg. Annual Return (%)	St Dev (%)	Loss Freq. (%)	Deepest Drawdown (%)	Longest Time to Recover (yrs)	Ulcer Index	Worst 10-year Return (%)	Median 10-year Return (%)	Best 10-year Return (%)	30-year SWR (%)	40+ year PWR (%)
Large Cap Blend	8.1	17	29	50	13	20.1	-3.9	6.9	16.2	3.9	3
Small Cap Value	10.9	18.6	25	50	6	12	2.4	10.6	20.3	6.6	6.3
Int'l (Developed)	6.7	20.2	35	47	14	18.7	-1.5	3.9	14.6	3.6	1.5
Int'l (Emerging)	8.5	27.4	40	62	18	25.3	-9.2	5.5	23.8	3.1	1.7
Real Estate	8.9	17.2	23	49	7	14.2	2.9	8.2	15.2	5.2	4.3
Utilities*	8.6	15.1	25	44	4	7.9					
Long Term Bonds	4.7	13.6	40	51	16	15.9	-6.8	5.1	11.4	3.4	2
Gold	5.8	23.8	49	78	43	46.9	-8.4	1.4	21.7	1.3	0

\*Data not available on Portfolio Charts; gathered from Portfolio Visualizer with 23 year time span versus 53

Figure 17 – Performance Metrics and Comparisons of Individual Asset Classes

A couple of conclusions can be drawn from Figure 17. Looking at Deepest Drawdown, there is no “safe” asset in this mix. Short-term treasuries might have fit that bill best with a worst-case drawdown of 20%, though time to recover was 21 years. Their drag on returns—with an Average Annual Return of 1.8%—does not give them a place in the Pathway to FI portfolios.

Small Cap Value wins most of the metrics, and if only one asset could be held it seems that the FIRE community should consider Small Cap Value over Total Stock Market (Total Stock Market performs very



similarly to Large Cap Blend since that is most of its makeup). It does come with its share of volatility, however, and some large 3-year and 5-year losses would have to be endured. Many people in the personal finance world are coming to realize that Small Cap Value is a must-have in a strong buy-and-hold portfolio.

Gold is a terrible investment on its own with some of the highest volatility, the deepest drawdown that did not fully recover over a lifetime of investing, and lower average returns than any of the equities in this group. Despite this, it is when those returns did come and the fact that it is not correlated with anything else that make gold interesting and give it a place in the Pathway to FI portfolios. Rather than explain this here, the reader can refer to the article [Three Secret Ingredients of the Most Efficient Portfolios](#) for an explanation of just how valuable gold can be in a well-diversified portfolio. In addition to gold, this article makes a case for Small Cap Value and Long-Term Bonds, which are key ingredients in the Pathway to FI portfolios at various stages.

Figure 18 plots Average Annual Return of each asset class versus its Ulcer Index. Utilities needs to be taken with a grain of salt since it does not have the same duration of data and metrics were likely calculated on a different scale, but it should roughly fall near REITs with slightly lower return and risk. Gold and Small Cap Value stand out at opposite ends, and the potential risk versus reward of including Emerging Market stocks within an International allocation can be seen as well. Large Cap Blend, the core of most portfolios, falls squarely in the middle.

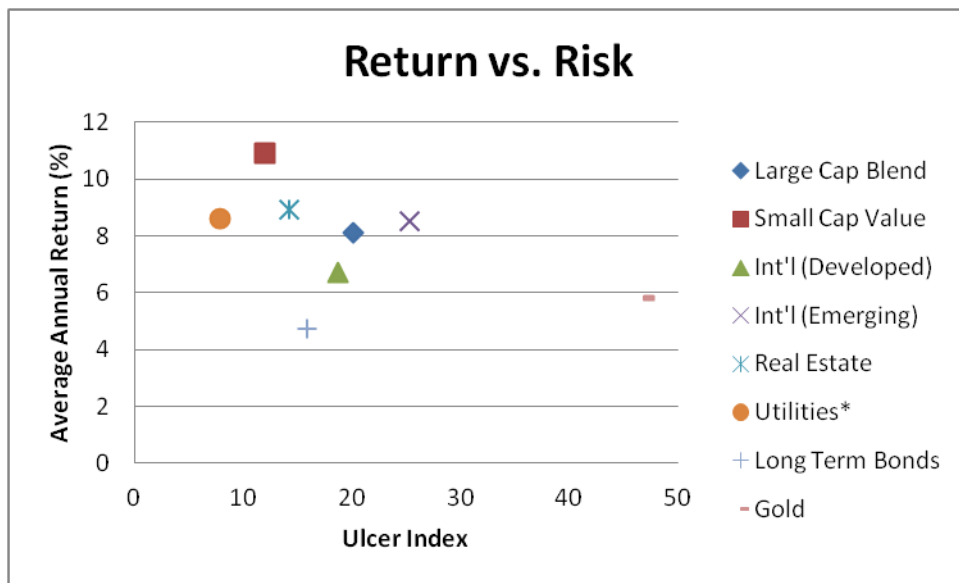


Figure 18 – Average Annual Return versus Ulcer Index for Individual Asset Classes

Finally, Figure 19-Figure 21 show where the Pathway to FI model portfolios fall in Risk versus Return relative to the asset classes that they are constructed from.

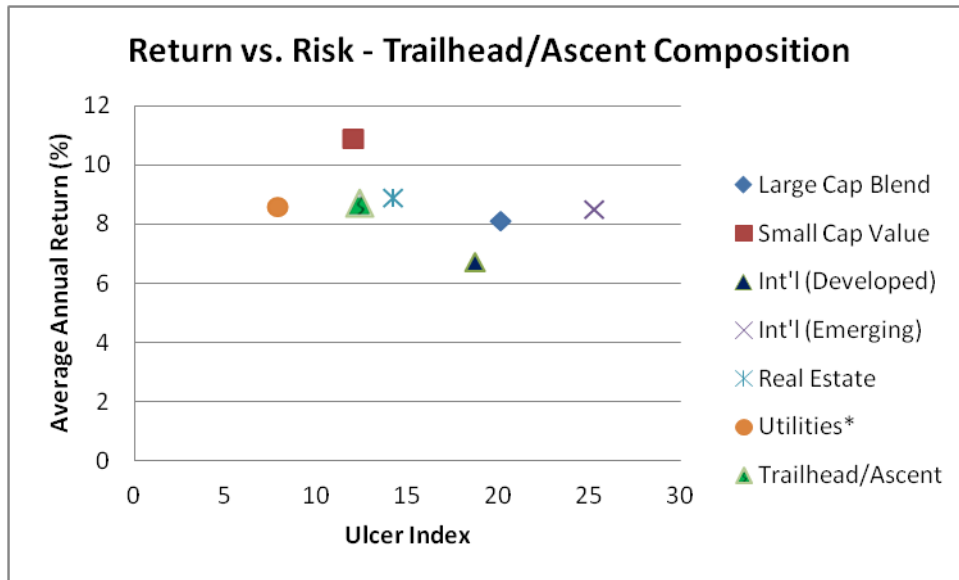


Figure 19 – Trailhead/Ascent Portfolio Composition, Return versus Risk Viewpoint

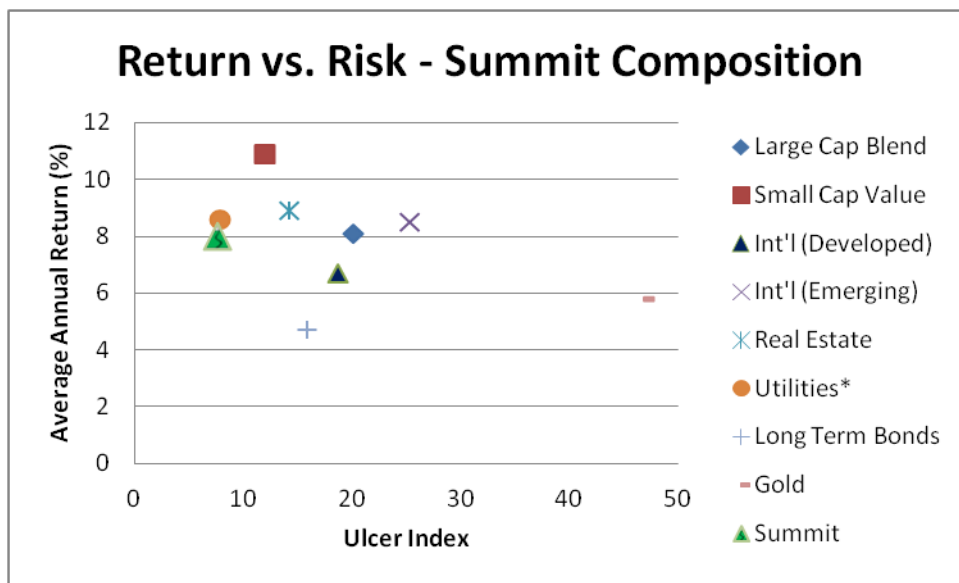


Figure 20 – Summit Portfolio Composition, Return versus Risk Viewpoint

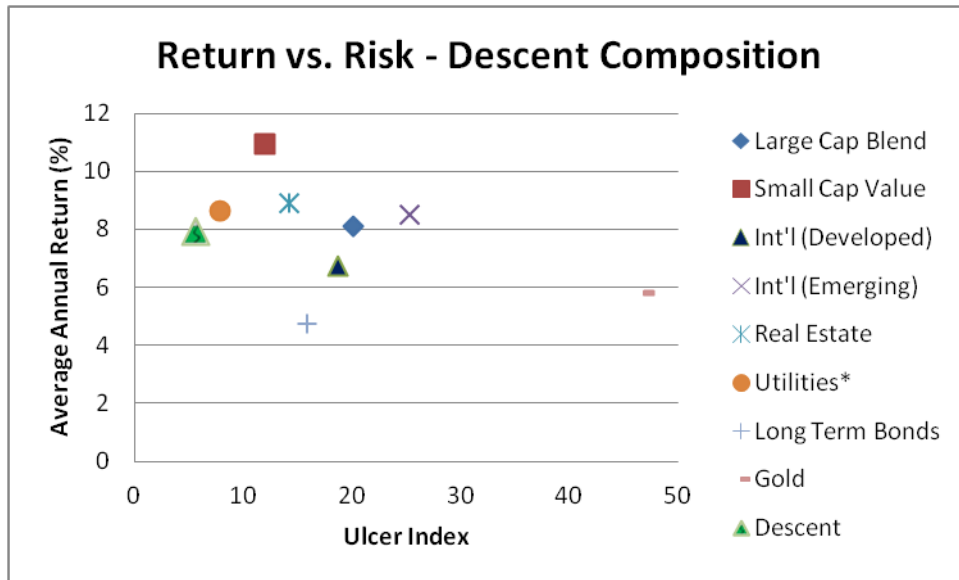


Figure 21 – Descent Portfolio Composition, Return versus Risk Viewpoint

### 5.1.3. Effect of Diversifying within International Stocks

Model portfolio performance was presented in section 3.0 assuming that international stocks are held in a Total International Stock Market fund. As I have shown above, emerging markets are more uncorrelated with the US market and have produced higher returns than international developed markets at the expense of volatility.

What if we also considered international small cap value since it has performed so well for US?

The following figures show how model portfolio performance differs if we diversified further within international stocks.

The percentages are small relative to the whole portfolio, as seen in Figure 22, ranging from 6% to 16% split between international small cap value and emerging markets. According to Figure 23, this results in small differences in portfolio performance. There is a slight improvement in average and worst-case returns across the board. But this does not result in improved SWR or PWR.

	Large Cap Blend (LCB)	Small Cap Value (SCV)	LCB Int'l	SCV Int'l	Emerging Markets	Real Estate	Utilities	Long Term Bonds	Gold
S 1/2 Trail/Ascent	35	30	9	8	8	5	5		
S 3 Summit	25	25	8	6	6	5	5	10	10
S 4 Descent	20	20	4	3	3	10	10	15	15

Figure 22 – Model portfolios with further international diversification

		Average		Loss	Deepest	Longest	Worst 10-	Median	Best 10-	30-year	40+ year	
		Annual	Std. Dev.									Draw-
		Return	(%)	Freq. (%)	down (%)	Recover	Ulcer	Return	Return	Return	SWR (%)	PWR (%)
		(%)	(%)			(yrs)	Index	(%)	(%)	(%)		
Trail/Ascent	baseline	8.7	15.7	25	47	9	12.4	0	9.1	13.6	5.5	4.7
	diversify int'l	9	15.9	27	48	9	12	1	9.2	13.7	5.4	4.7
Summit	baseline	8	12.3	25	32	5	7.7	2.4	7.8	11.4	6.2	5.3
	diversify int'l	8.3	12.5	25	32	5	7.6	3.2	8.3	11.8	6.2	5.3
Descent	baseline	7.9	10.8	23	24	5	5.7	3.8	7.4	10.5	6.5	5.6
	diversify int'l	8	10.9	19	24	5	5.7	4.3	7.8	10.3	6.5	5.5

Figure 23 – Model portfolio performance baseline versus further international diversification

If you are interested in adding a few diversified international funds to your portfolio, first consider the costs involved. Most international funds have larger expense ratios than US funds. Small performance improvements could easily be eliminated if you have to pay an extra 0.2% or more in fees to diversify in this way. On the other hand, [FZILX](#) from Fidelity has a 0% expense ratio, which can't be beat!

## 5.2. Metrics Definitions

- **Average Annual Return** – the average annual inflation-adjusted return from 1970 to mid-2022
- **Standard Deviation (Std. Dev.)** – the statistical uncertainty of the average real return, where 68% of returns fall within one standard deviation, 95% fall within two standard deviations, and >99% fall within three standard deviations of the average
- **Loss Frequency (Freq.)** – the percentage of years where the portfolio lost money since 1970
- **Deepest Drawdown** – the deepest compound loss since 1970 using year-end data
- **Longest Time to Recover** – the years it took to permanently recover the initial inflation-adjusted account value during the worst-case drawdown
- **Ulcer Index** – A composite measure of drawdown depth, length, and frequency (more details and calculation [here](#)) such that a higher number represents deeper, longer, and more frequent drawdowns
- **Worst, Median, and Best 10-yr Returns** – Calculated using the worst, total, and best 10-year periods since 1970
- **Safe Withdrawal Rate (SWR)** – the constant inflation-adjusted annual spending level that never ran out of money in any 30-year retirement since 1970
- **Perpetual Withdrawal Rate (PWR)** – the constant inflation-adjusted annual spending level that sustained the initial inflation-adjusted principal over every 30-year retirement and is expected to be sustainable perpetually at that point