

# Using Fundamental Index<sup>®</sup> Strategies to Increase Return, Reduce Risk, and Improve Portfolio Efficiency<sup>1</sup>

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## INTRODUCTION

Investors love high returns and hate volatility. That's the not-so-controversial premise behind mean-variance optimization, a useful tool to create efficient portfolios from individual assets. In this paper we show how replacing traditional equity index strategies with a Fundamental Index<sup>®</sup> approach can raise the mean-variance frontier, providing investors with both higher returns and lower volatility. We also show the helpful implications for asset allocation between equity and fixed income in an investor's portfolio.

With the publication of his article "Portfolio Selection" in the 1952 issue of the *Journal of Finance*, Harry Markowitz cemented mean-variance analysis as the cornerstone of Modern Portfolio Theory (MPT) and began his ascent to the Nobel Prize. According to MPT, investors should seek the highest possible returns for a given level of risk, and accept the minimum possible risk for a given level of return. We can, therefore, characterize *efficient* portfolios: for any given level of risk, this is the portfolio that delivers the maximum possible return, and for any given return, the minimum risk. Intelligent investors should only accept portfolios that lie near the efficient frontier, and avoid suboptimal portfolios that deliver lower returns or increased risk.

This creates an obvious trade-off. Once the efficient frontier is fixed, investors must decide if they would prefer to seek out a higher return (which necessitates increasing their risk exposure) or reduce their risk (and, therefore, accept a lower return). Exactly how much extra volatility an investor is willing to accept in an effort to increase returns depends on that individual's risk aversion. However, no investor would turn down the "free lunch" of a higher return with equal or lesser volatility.

One of the key insights from Markowitz's work is that a portfolio of risky assets, when properly constructed, can actually contain less risk than the individual assets themselves. This is due to the correlation effect. Suppose two assets have exactly the same expected return and volatility, but their returns tend to move in opposite directions—or even in the same direction but to different degrees and perhaps not always—then their volatilities will, to an extent, cancel out one another. Markowitz proved that a portfolio holding a convex combination of both assets will

have a lower volatility than the individual assets. He provided a mathematical basis for diversification and for finding “efficient” portfolios.

## **USING MEAN-VARIANCE ANALYSIS TO IMPROVE PORTFOLIO ALLOCATION**

The key components of mean-variance analysis are expected returns, expected variances, and covariances. We start our analysis by comparing the returns and volatilities of five, Research Affiliates Fundamental Index (RAFI<sup>®</sup>) strategies<sup>2</sup> to their capitalization-weighted counterparts. A historical summary for the years 1994–2007 is presented in **Table 1**. We can see that in each of the five markets, the RAFI strategy is mean-variance superior to the alternative. In fact, in nearly every comparison the RAFI strategy has higher mean *and* lower standard deviation. The sole exception is itself rather interesting: we find a lofty 9.2% increase in our annual return in the emerging markets, though at the cost of a slightly higher volatility.

So at first glance, replacing a traditional cap-weighted strategy with a Fundamentals Weighted<sup>®</sup> strategy certainly seems like a compelling idea. But how should we go about doing this?

Although a simple trade from one strategy to another is a good first step, mean-variance analysis shows us how we can better position our portfolio on the efficient frontier. Rather than simply moving our equity allocation from cap-weighted strategies to Fundamentals Weighted strategies, we can decide to reduce our “equity bet” and, thus, lower volatility without giving up any expected return. Or, conversely, we can increase our equity allocation and seek a higher expected return without any increase in our volatility. Both of these strategies would be a superior allocation rather than simply replacing the cap-weighted strategy dollar for dollar.

To start, we gather the building blocks for a mean-variance analysis: the expected returns, standard deviations, and correlations for our assets. In most cases, this includes both a conventional cap-weighted portfolio and a Fundamental Index portfolio. For the equity space, we examine the following categories:

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<sup>2</sup> RAFI performance results used throughout this paper represent back-tested performance based on rules used in the creation of each index. The material contained in this paper is for general information purposes only. The analysis relates only to a hypothetical model of past performance of the RAFI strategies represented and not to any asset management products based on the indexes and is not a guarantee of future performance and is not indicative of any specific investment. No allowances have been made for trading costs or management fees which would reduce investment performance.

- Large U.S. companies (RAFI US Large Company [RAFI US Large] and Russell 1000)<sup>3</sup>;
- Small U.S. companies (RAFI US Small Company [RAFI US Small] and Russell 2000);
- Emerging Market equities (RAFI Emerging Markets and FTSE All World EM);
- International Developed Large companies (RAFI International Large and FTSE All World ex US);
- International Developed Small companies (RAFI Small International and FTSE All World Small ex US);
- A diversified fixed income strategy (Lehman Aggregate); and
- A risk-free investment (U.S. 3-month T-bills).

While recognizing that past is not prologue, we make the simplifying assumption that our best estimate for future returns, volatilities, and correlations are the historically observed returns, volatilities, and correlations (we use data from the period 1994–2007). This assumption is, of course, an oversimplification, but it is an interesting test. The historical returns and standard deviations are shown in **Table 1**, and the correlation matrix for all of these asset classes is displayed in **Table 2**.

With these inputs we are ready to build our efficient frontiers. We utilize a computer optimization routine to, bit by bit, construct the portfolio that delivers the lowest variance for a given level of return. We run two separate optimizations. The first includes the five cap-weighted strategies along with the bond and risk free options. The second includes the five RAFI strategies along with the bond and risk-free options. The results of the optimization are presented in **Figure 1**. We can see that the RAFI efficient frontier lies above and to the left of the cap-weighted efficient frontier across the entire span of returns. That is, for every possible maximum return, the RAFI portfolio delivers lower risk; and for every possible minimum risk, the RAFI portfolio delivers greater return. Expanding one's opportunity set by including RAFI strategies in a portfolio enables a new spectrum of expected returns.

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Due to the less-than-perfect correlations between the RAFI strategies and the cap-weighted strategies, is it possible that the efficient frontier could be expanded even further by including all 12 of these assets in a portfolio? To test this possibility, we run the 12×12 correlation matrix and expected returns through the optimization routine. However, the optimizer recommends zero weight on all cap-weighted strategies in every scenario that we test. The cap-weighted strategies are dominated by both the higher mean and lower variance of their RAFI portfolio counterparts, and the slight diversification benefit provided by the cap-weighted strategies is swamped by the negatives of their lower return and higher variance. Therefore, we can safely ignore them when forming our efficient frontier and focus on the one presented by the RAFI strategies.

## RESULTS OF THE ANALYSIS

We present the optimizer's allocations for the RAFI portfolio in **Table 3** and for the cap-weighted portfolio in **Table 4** (the combined optimized portfolio is identical to the RAFI portfolio and, thus, not included). Graphical representations of these allocations are shown in **Figure 2** and **Figure 3**. We can see several key differences. First, for any given level of return, the cap-weighted portfolio requires a much greater mix of equity than the RAFI portfolio. Second, the optimal RAFI portfolios tend to include a more diversified mix of equity assets than the cap-weighted portfolios (although this “corner solution” problem is fairly typical in mean-variance analysis and will be discussed in more detail later). Third, much higher expected returns are possible with a RAFI portfolio and these can be achieved even *without* increasing our portfolio risk!

The first point is quite simple. Because the RAFI strategies provide higher return with lower risk, they allow a decreased allocation to equity in order to achieve any given level of return. We highlight this point in **Table 5**. For example, a cap-weighted investor aiming for a 9% expected return needs to place 59% of his investment dollars into equities and 41% into fixed income. This expected return to this proto-typical 60/40 split can be matched by a RAFI investor who places just 28% into equity. Furthermore, the RAFI investor can expect 4.9% volatility compared to 7.5% for the cap-weighted investor. This drastic decrease in risk comes without giving up *any* expected return! This pattern holds true regardless of what level of return the investor requires.

Moving to RAFI strategies allows an investor to drastically reduce their equity bet and lower their risk.

Investors can also choose to take advantage of the flip-side of the trade-off. Instead of lowering their risk, why not keep the same risk but enjoy an increased expected return? Again, let's start with the 60/40 cap-weighted portfolio. This 7.52% standard deviation is matched by the RAFI portfolio that invests 47% in equity and 53% in bonds. The expected return on the RAFI portfolio, however, is 11% per year—a full 2% advantage over the cap-weighted portfolio. By shifting to RAFI strategies and *reducing* our equity exposure by 13%, we end up *increasing* our expected returns by 2% per year while maintaining the same volatility.

Of course, a simple improvement to a cap-weighted investor's portfolio could be accomplished by merely substituting the cap-weighted strategies with the corresponding RAFI strategies. This, however, will lead to an inefficient portfolio. As an example, let's take the cap-weighted portfolio mix with an expected return of 10%. **Table 6** shows what a simple replacement with RAFI strategies will accomplish—a boost in expected return from 10% to 11.45% and a decrease in volatility from 10.05% to 9.28%. Clearly this is an improvement.

Knowing what we have learned about efficient portfolios, we can do better. This substitute portfolio does not lie on the efficient frontier. If we want to achieve an 11.45% expected return, we can do so with the mix in Optimal Portfolio A and, in the process, further reduce our volatility to 8.17%—over a full percentage point lower. If we are satisfied with assuming 9.28% volatility, we can choose the mix in Optimal Portfolio B and increase our expected return to 12.20%. Or we could select Optimal Portfolio C and match the original 10% return, while reducing our volatility to 6.15%. Moving investment dollars to RAFI strategies is an excellent first step, but doing so intelligently and efficiently can nearly *double* the benefit of this trade.

## **PAST IS NOT PROLOGUE**

Any mutual fund prospectus carries the SEC mandated language: "... securities trading has risk of loss and may not be suitable for all persons.... past results are not necessarily indicative of future results." Yet our industry is rife with comparisons based on past returns, which we, as

investors, study with great interest. Ads are published touting the best performing funds, even though the contrarian might well ask, “Which are your worst performing funds”?

At Research Affiliates we have written extensively on the subject of forward-looking returns, consistently taking a view that future long-term returns will be significantly lower than we’ve enjoyed in the past. Can bonds continue to deliver 6.1% when current yields are 4–5%? Not on a long-term basis. The current yield of 4–5% is a more sensible expectation. We also believe that stocks will not deliver the 10–12% that cap-weighted indexes have produced since 1994. The combination of current dividend yields at 2–3% and long-term historical growth rates of 3–5% point to a long-term expectation of 5–8%, not the lofty historical figures. What about the historical excess returns we utilize in this article? Can the RAFI portfolio continue to produce 2–3% higher returns than the cap-weighted indexes? It turns out that our optimizers continue to allocate *nothing* to the cap-weighted indexes, even if the incremental expected return is 1–2% (or even less)!

The message of lower returns is not one that the investment community necessarily welcomes. But, which is more advantageous—making conservative return assumptions and finding that we’re wealthier than we’d planned, or making aggressive assumptions and finding that we’re poorer than we’d hoped? It’s a dangerous folly to plan our futures with too aggressive expectations; yet, advisors are often fired if they are insufficiently optimistic! In our view, it’s very useful to repeat this analysis with far more conservative figures. As it turns out, while this hugely affects the forward-looking returns, it does not materially alter the asset allocation that our optimizer recommends!

We re-run the optimization routine using lower expected returns as well as a reduced gap between RAFI strategies and cap-weighted strategies as shown in **Table 1**. The efficient frontiers for an optimization using these conservative forward-looking returns are shown in **Figure 4**. Although the frontier is, of course, shifted downward, the important point remains that for *any* level of risk–return trade-off, the efficient frontier created by using the RAFI strategies lies above and to the left of the cap-weighted efficient frontier. Furthermore, when all 12 assets are included in a single optimization routine, the optimizer still recommends a zero investment in all cap-weighted strategies.

The allocation decisions are depicted in **Figures 5 and 6** and further detailed in **Tables 7 and 8**. We can see that all of the desirable allocation properties from the first optimization still hold when we use the conservative returns. The Sharpe ratios for all of the RAFI portfolios are higher, signifying mean-variance superiority; the higher efficient frontier allows for a reduced equity bet; and higher expected returns are possible by using RAFI strategies, even without increasing the volatility of our portfolio.

## **SOME CAVEATS**

We also need to discuss the shortcomings of this mean-variance technique. While it boasts very elegant theoretical underpinnings, the real world implementation of this analysis requires a good deal of approximations.

For starters, we need accurate estimates of the *future* mean returns, variances, and covariances of all these asset classes going forward. As is all too often done, our first analysis simply used historical returns as a reasonable guide to future returns. If future returns differ from the historical numbers we base our projections on, the efficiency of these portfolios will suffer.<sup>4</sup> We are on record suggesting that forward-looking returns will be dramatically lower than the historical figures we show here. We find that we can use far more conservative return assumptions without materially changing the implications for the asset allocation along our efficient frontier.

Finally, optimization can be a garbage-in, garbage-out tool. If our forward-looking estimates of return, risk, and covariances are wrong, so too will be our “solutions.” Mean-variance analyses are notorious for “corner solutions” where zero weight is given to many of the investment options. In our first analysis, we see that the International strategies are never used. The Small International strategies have superior properties and, thus, are relatively more attractive to the optimizer. The optimizer is correct in this judgment *if* the inputs we have given it are true. But due to some level of uncertainty that future asset returns will match their historic properties, we cannot be so sure. Perhaps the International strategies should indeed have higher returns, or

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<sup>4</sup> Furthermore, these portfolios will be only *ex ante* efficient. The realized *ex post* returns will most certainly allow a backward-looking investor to form mean-variance superior portfolios. And (due to the noise in small samples) this will be true even if the expected means, variances, and covariances we start with are absolutely correct.

lower volatilities, or different correlation properties. Without a doubt, at least some of the information we begin our analysis with will not be entirely accurate.

We can mitigate this problem by employing an *ad hoc* shrinkage of our estimates: we can take the optimizer recommendations as a guide rather than mathematical gospel. We can be relatively secure in our recommended mix of equity, fixed income, and T-bills—those asset classes have well established properties. However, some adjustment to the individual components of the equity allocation might certainly be in order. Different equity styles can go through stretches, sometimes decades long, of unusual returns, despite all expectations to the contrary. Recognizing the uncertainty in our estimates and adjusting allocations, even just around the edges, is entirely appropriate. For example, instead of accepting a zero allocation to the International strategy, it would be entirely reasonable to invest a minimal amount—say 5–10%—in each of the International Large and International Small strategies, while reducing the Emerging Markets strategy allocation to compensate. A small amount of exposure to all equity styles can provide a good degree of diversification at generally minimal cost. This optimization delivers powerful implications about a shift from cap-weighted to RAFI strategies, but it is also important to recognize the limits of the model and utilize a modicum of common sense to balance out potential shortcomings.

Our optimizer, given a choice between cap-weighted strategies and RAFI strategies, invests nothing in the cap-weighted choices. That makes sense if (1) the RAFI strategy is lower risk, (2) the RAFI strategy and capitalization weighting are very highly correlated, and (3) the RAFI portfolio has higher returns. We are highly confident in the first two. As originators of the RAFI concept, we are also highly confident of the third assumption, and fully endorse the mean-variance portfolios detailed in this paper. However, we readily acknowledge that not everyone shares our view. If you fall amongst those who hesitate to accept the returns presented here, consider the advice that Watson Wyatt, the global institutional consultant, recently delivered to its clients: diversify your index exposure. If you are not sure that capitalization weighting will win and you're not sure that Fundamental Index portfolios will win, spread your bets! If you have a high level of uncertainty about future returns, mixing RAFI strategies with cap-weighted strategies will move your portfolio closer to the efficient frontier. If you believe that the expected returns on the RAFI strategies are only in line with those for the cap-weighted strategies, your

portfolio will benefit from the lower variance and imperfect correlations provided by the addition of the RAFI strategies into your equity mix. And in this case, we suspect your portfolio might even surprise you with upside return.

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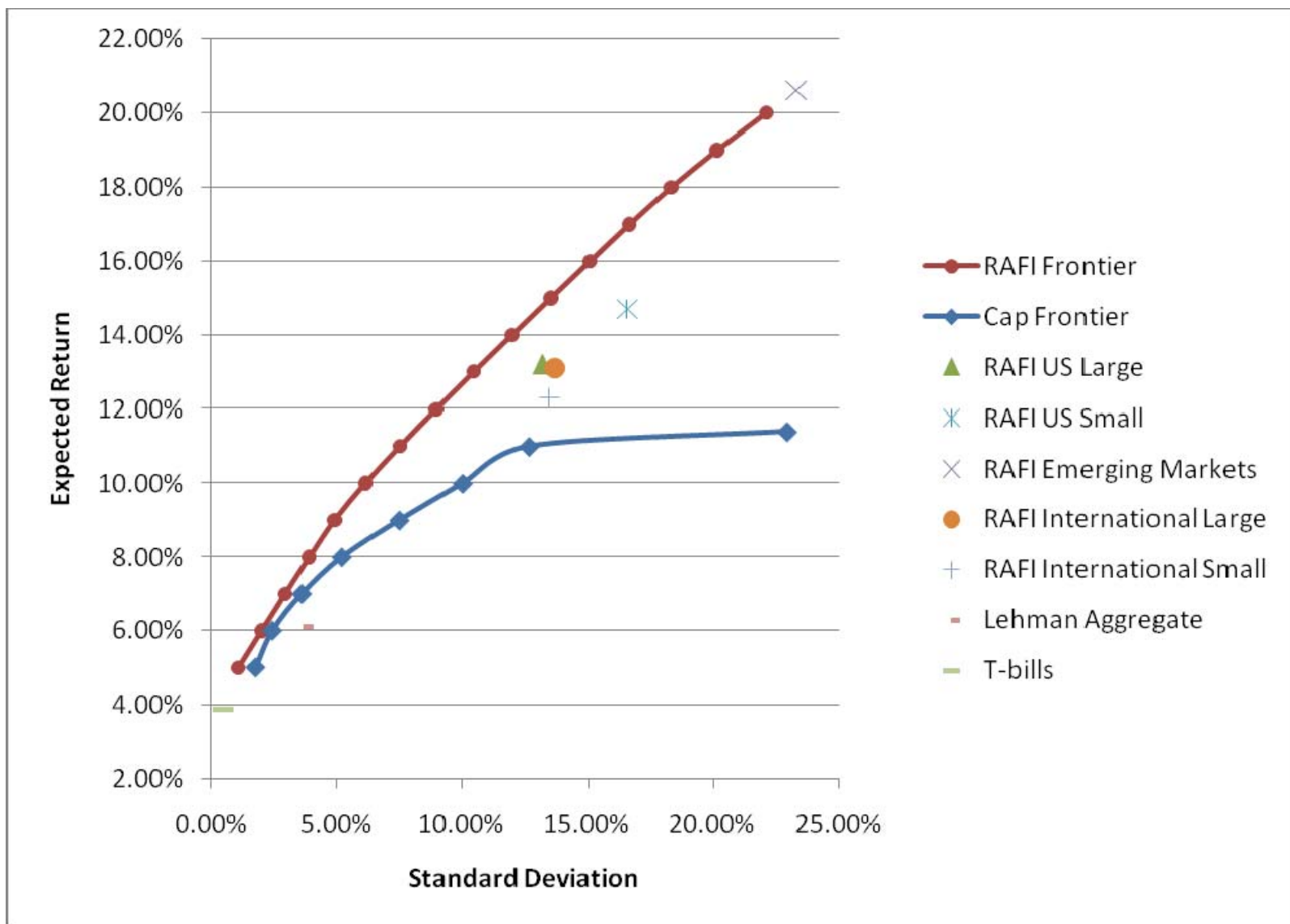
**Table 1: Comparative Statistics, 1994–2007,  
and Illustrative Conservative Expectations**

<b>Asset Class</b>	<b>14-Year Returns</b>	<b>Standard Deviation</b>	<b>Conservative Returns</b>
RAFI US Large	13.2%	13.2%	7.0%
Russell 1000	11.1%	14.0%	6.0%
RAFI US Small	14.7%	16.6%	8.0%
Russell 2000	10.8%	18.2%	7.0%
RAFI Emerging Markets	20.6%	23.3%	10.0%
FTSE All World (AW) EM	11.4%	23.0%	8.0%
RAFI International Large	13.1%	13.7%	7.0%
FTSE AW ex US	9.7%	14.0%	6.0%
RAFI Small International	12.3%	13.5%	8.0%
FTSE Global Small ex US	10.8%	14.2%	7.0%
Lehman Aggregate	6.1%	3.7%	4.5%
U.S. 3-month T-bills	3.9%	0.5%	3.0%

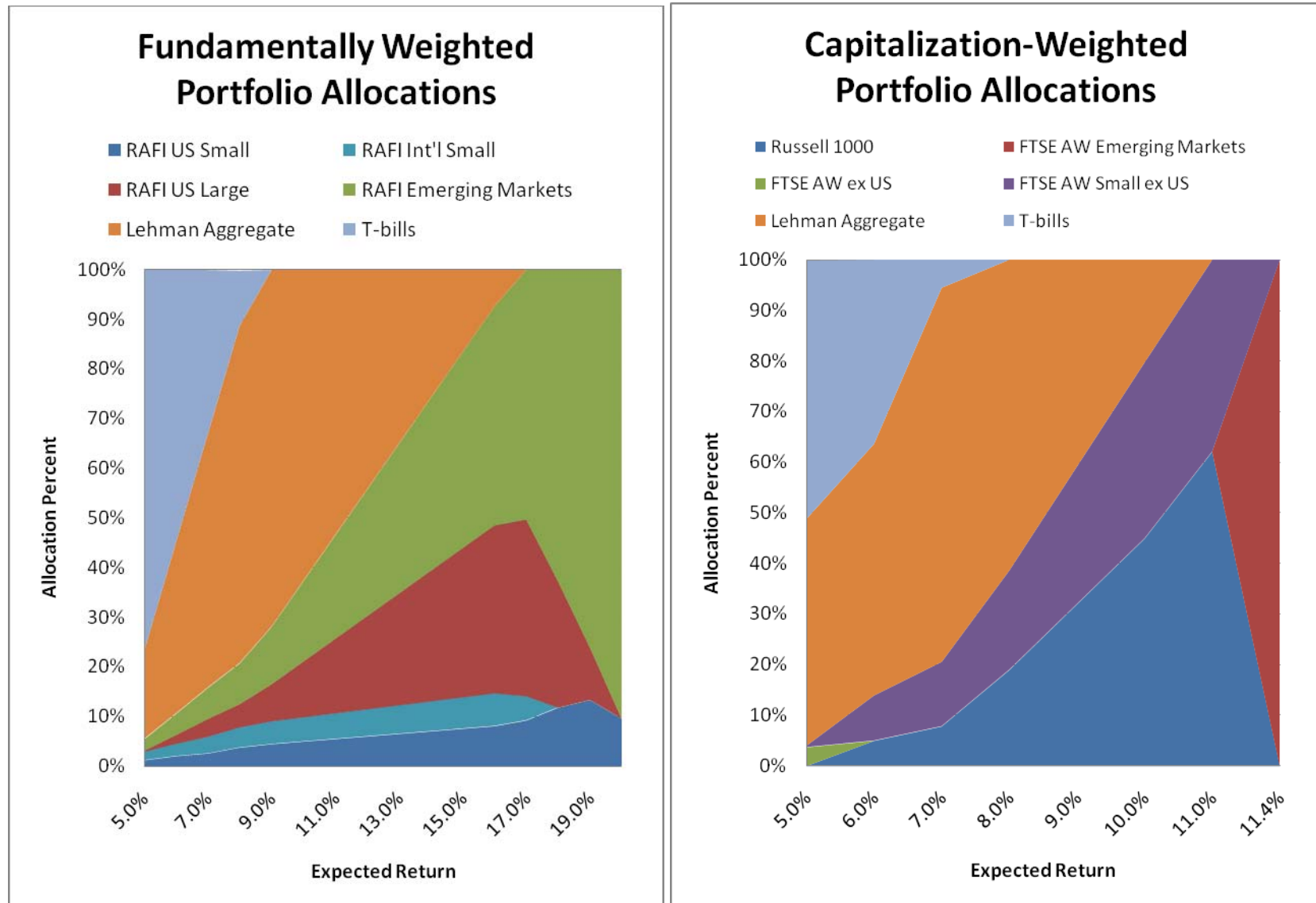
**Table 2: Correlation Matrix**

	RAFI US Large	Russell 1000	RAFI US Small	Russell 2000	RAFI Emerging Markets	FTSE AW EM	RAFI International Large	FTSE AW ex US	RAFI Small International	FTSE AW Small ex US	Lehman Aggregate	T-bills
<b>RAFI US Large</b>	1.00	0.93	0.79	0.70	0.61	0.63	0.72	0.73	0.51	0.56	0.02	0.09
<b>Russell 1000</b>		1.00	0.77	0.76	0.62	0.66	0.71	0.77	0.50	0.60	0.01	0.07
<b>RAFI US Small</b>			1.00	0.95	0.64	0.68	0.66	0.69	0.58	0.69	-0.08	-0.03
<b>Russell 2000</b>				1.00	0.60	0.67	0.62	0.69	0.53	0.68	-0.08	-0.03
<b>RAFI Emerging Markets</b>					1.00	0.90	0.68	0.70	0.63	0.72	-0.14	-0.13
<b>FTSE AW EM</b>						1.00	0.69	0.72	0.62	0.75	-0.12	-0.11
<b>RAFI International Large</b>							1.00	0.96	0.89	0.86	-0.07	-0.06
<b>FTSE AW ex US</b>								1.00	0.82	0.87	-0.09	-0.07
<b>RAFI Small International</b>									1.00	0.92	-0.04	-0.21
<b>FTSE AW Small ex US</b>										1.00	-0.13	-0.18
<b>Lehman Aggregate</b>											1.00	0.14
<b>T-bills</b>												1.00

**Figure 1: Efficient Frontiers for RAFI Portfolio and Cap-Weighted Portfolio**



Figures 2 and 3: RAFI Portfolio and Cap-Weighted Portfolio Allocations



**Table 3: RAFI Portfolio Allocations**

<b>E[r]</b>	<b>StD</b>	<b>SHARPE</b>	<b>RAFI US Large</b>	<b>RAFI US Small</b>	<b>RAFI Emerging Markets</b>	<b>RAFI International Large</b>	<b>RAFI Small International</b>	<b>Lehman Aggregate</b>	<b>T-bills</b>
5.00%	1.08%	1.85	0%	1%	2%	0%	2%	18%	77%
6.00%	2.01%	1.50	2%	2%	4%	0%	2%	35%	55%
7.00%	2.96%	1.35	4%	3%	6%	0%	3%	51%	33%
8.00%	3.92%	1.28	5%	4%	8%	0%	4%	68%	11%
9.00%	4.92%	1.22	8%	4%	12%	0%	5%	72%	0%
10.00%	6.15%	1.14	11%	5%	16%	0%	5%	63%	0%
11.00%	7.52%	1.06	15%	5%	21%	0%	5%	53%	0%
12.00%	8.97%	1.00	19%	6%	26%	0%	5%	44%	0%
13.00%	10.47%	0.96	23%	6%	30%	0%	6%	35%	0%
14.00%	11.99%	0.92	26%	7%	35%	0%	6%	26%	0%
15.00%	13.53%	0.89	30%	8%	40%	0%	6%	17%	0%
16.00%	15.09%	0.86	34%	8%	44%	0%	7%	7%	0%
17.00%	16.66%	0.84	36%	9%	50%	0%	5%	0%	0%
18.00%	18.32%	0.82	25%	12%	63%	0%	0%	0%	0%
19.00%	20.14%	0.79	11%	13%	76%	0%	0%	0%	0%
20.00%	22.11%	0.77	0%	10%	90%	0%	0%	0%	0%

**Table 4: Cap-Weighted Portfolio Allocations**

E[r]	Std	SHARPE	FTSE AW						
			Russell 1000	Russell 2000	Emerging Markets	FTSE AW ex US	FTSE AW Small ex US	Lehman Aggregate	T-bills
5.00%	1.79%	1.12	0%	0%	0%	4%	0%	45%	51%
6.00%	2.46%	1.22	5%	0%	0%	0%	9%	50%	36%
7.00%	3.64%	1.10	8%	0%	0%	0%	13%	74%	6%
8.00%	5.24%	0.95	19%	0%	0%	0%	20%	61%	0%
9.00%	7.52%	0.80	32%	0%	0%	0%	27%	41%	0%
10.00%	10.05%	0.70	45%	0%	0%	0%	35%	20%	0%
11.00%	12.68%	0.63	62%	0%	0%	0%	38%	0%	0%
11.40%	22.95%	0.37	0%	0%	100%	0%	0%	0%	0%

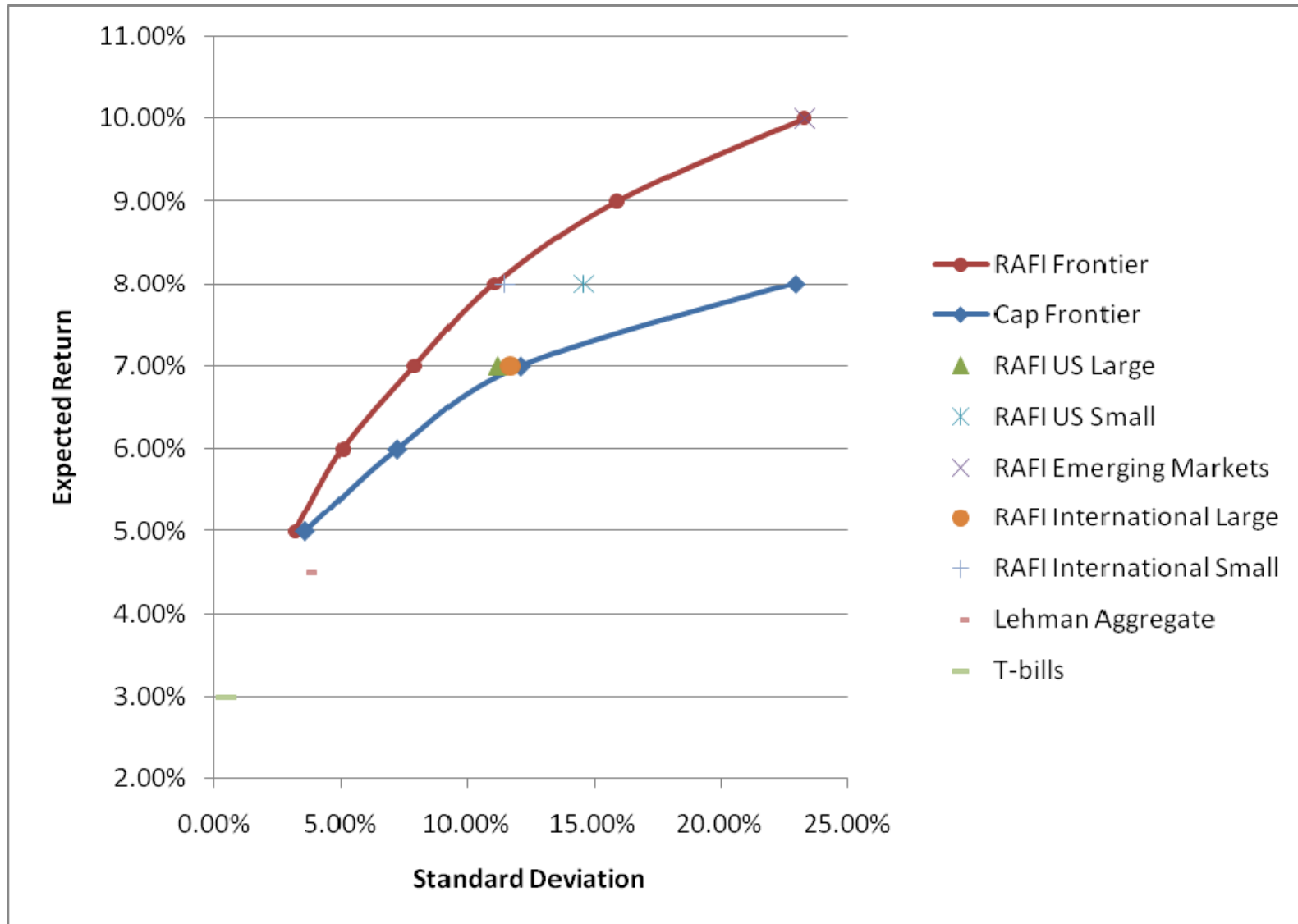
**Table 5: Reducing the Equity Bet**

E[r]	RAFI				Cap-Weighted				Difference	
	StD	Bonds	T-bills	Total Equity	StD	Bonds	T-bills	Equity	Reduced Equity	Reduced StD
5%	1.1%	18%	77%	5%	1.8%	45%	51%	4%	2%	-0.7%
6%	2.0%	35%	55%	11%	2.5%	50%	36%	14%	-3%	-0.5%
7%	3.0%	51%	33%	16%	3.6%	74%	6%	21%	-5%	-0.7%
8%	3.9%	68%	11%	21%	5.2%	61%	0%	39%	-18%	-1.3%
9%	4.9%	72%	0%	28%	7.5%	41%	0%	59%	-31%	-2.6%
10%	6.1%	63%	0%	37%	10.0%	20%	0%	80%	-42%	-3.9%
11%	7.5%	53%	0%	47%	12.7%	0%	0%	100%	-53%	-5.2%
12%	9.0%	44%	0%	56%	23.0%	0%	0%	100%	-44%	-14.0%
13%	10.5%	35%	0%	65%						
14%	12.0%	26%	0%	74%						
15%	13.5%	17%	0%	83%						
16%	15.1%	7%	0%	93%						
17%	16.7%	0%	0%	100%						
18%	18.3%	0%	0%	100%						
19%	20.1%	0%	0%	100%						
20%	22.1%	0%	0%	100%						

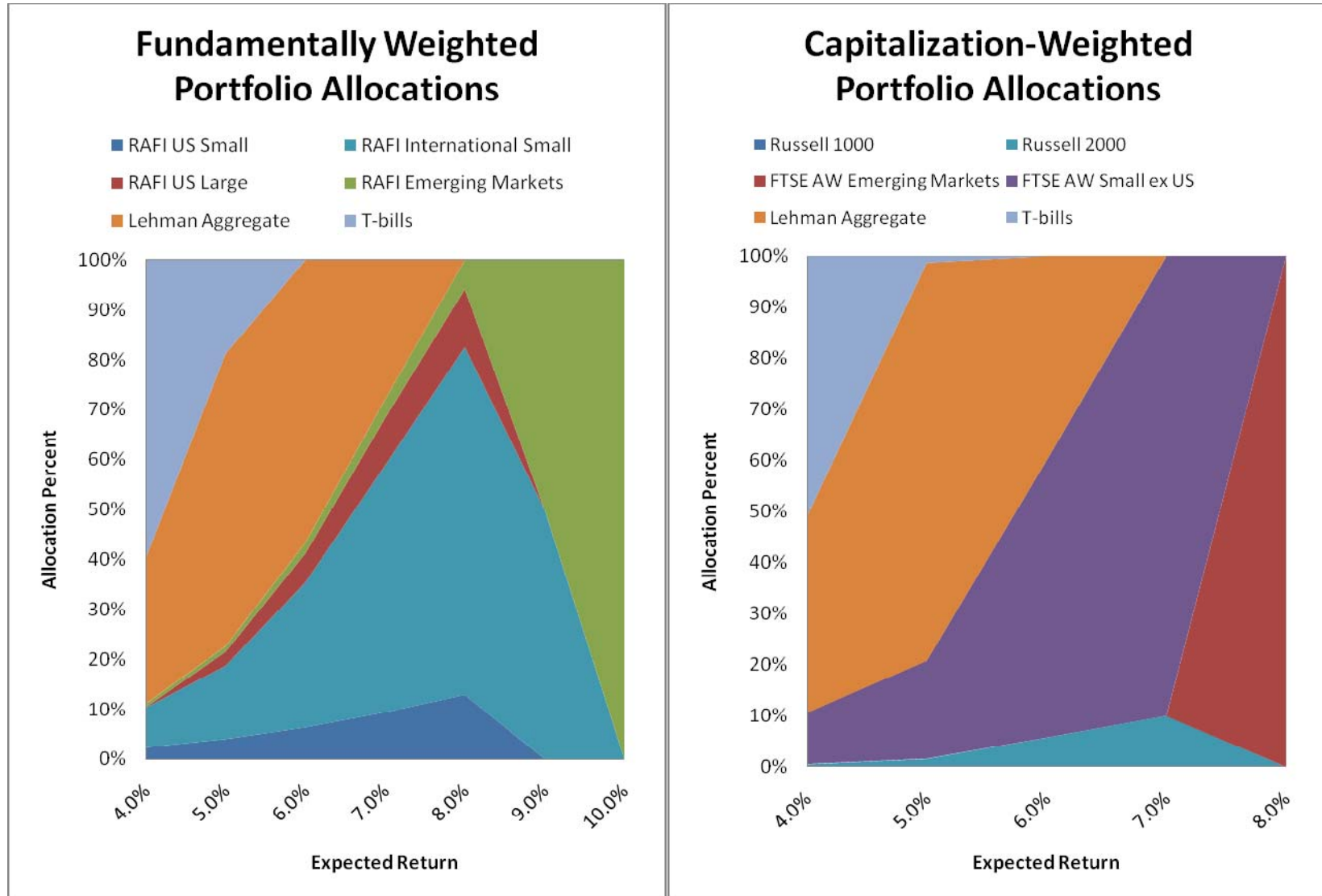
**Table 6: Why a Simple Replacement is Suboptimal**

	<b>E[r]</b>	<b>StD</b>	<b>Russell 1000</b>	<b>Russell 2000</b>	<b>FTSE AW Emerging Markets</b>	<b>FTSE AW ex US</b>	<b>FTSE AW Small ex US</b>	<b>Lehman Aggregate</b>	<b>T-bills</b>
<b>Cap-Weighted Strategies Only</b>	10.00%	10.05%	45%	0%	0%	0%	35%	20%	0%
			<b>RAFI US Large</b>	<b>RAFI US Small</b>	<b>RAFI Emerging Markets</b>	<b>RAFI International Large</b>	<b>RAFI Small International</b>	<b>Lehman Aggregate</b>	<b>T-bills</b>
<b>Simple Replacement</b>	11.45%	9.28%	45%	0%	0%	0%	35%	20%	0%
<b>Optimal Portfolio A</b>	11.45%	8.17%	17%	6%	23%	0%	5%	49%	0%
<b>Optimal Portfolio B</b>	12.20%	9.27%	20%	6%	26%	0%	6%	42%	0%
<b>Optimal Portfolio C</b>	10.00%	6.15%	11%	5%	16%	0%	5%	63%	0%

**Figure 4: Efficient Frontiers Using Conservative Forward-Looking Returns**



**Figures 5 and 6: RAFI Portfolio and Cap-Weighted Portfolio Allocations,  
Using Conservative Forward-Looking Returns**



**Table 7: RAFI Allocations Using Conservative Forward-Looking Returns**

<b>E[r]</b>	<b>StD</b>	<b>SHARPE</b>	<b>RAFI US Large</b>	<b>RAFI US Small</b>	<b>RAFI Emerging Markets</b>	<b>RAFI International Large</b>	<b>RAFI International Small</b>	<b>Lehman Aggregate</b>	<b>T-bills</b>
4.00%	1.62%	0.62	0%	2%	1%	0%	8%	29%	60%
5.00%	3.21%	0.62	3%	4%	1%	0%	15%	59%	19%
6.00%	5.09%	0.59	6%	6%	2%	0%	29%	57%	0%
7.00%	7.92%	0.51	9%	9%	4%	0%	50%	28%	0%
8.00%	11.07%	0.45	12%	13%	6%	0%	70%	0%	0%
9.00%	15.90%	0.38	0%	0%	50%	0%	50%	0%	0%
10.00%	23.29%	0.30	0%	0%	100%	0%	0%	0%	0%

**Table 8: Cap-Weighted Allocations Using Conservative Forward-Looking Returns**

<b>E[r]</b>	<b>StD</b>	<b>SHARPE</b>	<b>Russell 1000</b>	<b>Russell 2000</b>	<b>FTSE AW EM</b>	<b>FTSE AW ex US</b>	<b>FTSE AW Small ex US</b>	<b>Lehman Aggregate</b>	<b>T-bills</b>
4.00%	1.81%	0.55	0%	1%	0%	0%	10%	38%	51%
5.00%	3.60%	0.56	0%	2%	0%	0%	19%	78%	1%
6.00%	7.23%	0.41	0%	6%	0%	0%	54%	40%	0%
7.00%	12.12%	0.33	0%	10%	0%	0%	90%	0%	0%
8.00%	22.95%	0.22	0%	0%	100%	0%	0%	0%	0%