

An interesting question for investors in mutual funds and exchange traded funds (ETF's) is whether one set of mutual funds or ETF's is a direct substitute for another. This is particularly true for an investor seeking to determine the impact of reduced fees in switching from a portfolio of mutual funds to a portfolio of ETF's. When I discuss this issue with investors who own mutual funds but are interested in ETF's, the cost-benefit balance of selling mutual funds and then buying a portfolio of ETF's is hazy. Aside from the basic work involved, there is the issue of transaction costs and capital gains taxes. Further, there is often a concern as to whether one fund is truly equivalent to another, and this translates up to the total portfolio.

The relative benefits and potential costs of ETF's vs. mutual funds are nicely summarized by David Jackson's *Radical Guide to Investing* (link at the end of this article). In this online discussion of asset allocation, there is a model portfolio of ETF's and a portfolio of Vanguard's index funds that should be equivalent:

ETF Ticker	Equivalent Vanguard Fund	Sample Asset Allocation
IVV	Vanguard 500 Index Fund Investor Shares (VFINX)	35%
IJH	Vanguard Mid-Cap Index Fund Investor Shares (VIMSX)	10%
IWM	Vanguard Small-Cap Index Fund Investor Shares (NAESX)	5%
EFA	Vanguard Developed Markets Index Fund (VDMIX) (tracks MSCI EAFE)	20%
EEM	Vanguard Emerging Markets Stock Index Fund (VEIEX)	5%
SHY	Vanguard Short-Term Bond Index Fund Investor Shares (VBISX)	10%
IEF	Vanguard Intermediate-Term Bond Index Fund Investor Shares (VBIIX)	5%
TLT	Vanguard Long-Term Bond Index Fund (VBLTX)	5%
RWR	Vanguard REIT Index Fund Investor Shares (VGSIX)	5%

Radical Guide ETF Portfolio

The fees in the portfolio of ETF's are lower than the fees in the portfolio of Vanguard funds—by 0.05% per year. This alone does not tell us that the ETF portfolio will be

more attractive, of course. There are small differences between the ETF's and mutual funds over time but we hope that the total portfolio will look essentially equivalent. They may not totally equivalent, however. VGSIX, the Vanguard REIT fund in the portfolio, is supposed to track the Morgan Stanley REIT index and RWR is supposed to track the Dow Jones REIT index. Both are designed to track their indices with a correlation of 95%, which is very strong but not perfect correlation. This is but one example. IVV states that it may invest up to 10% of its assets in non-S&P500 assets, including futures and options. Even though these mutual funds and ETF's are designed to be equivalent, it is of interest to see how equivalent they are in the context of the total portfolio. This is particularly true in light of the fact that the spread in fees is quite modest in some cases—such as the one presented here.

If we compare the portfolio of ETF's to the portfolio of 'equivalent' Vanguard index funds, what would be the basis of comparison? First, we want to see that the portfolios are very similar on the basis of historical performance, although we expect slightly better total return from the ETF portfolio because of lower fees. We will want to compare the annual average return between the two portfolios, as well as the volatility in returns (as measured by the *standard deviation in annual return*). It will also be of interest to look at total yield of the two portfolios. But let's go a bit deeper. It is important to compare the Betas of the two portfolios. Differences in Beta mean that the two portfolios will respond differently to the movements in the broader market. Higher Beta means that a portfolio tend to amplify broader market action, while lower Beta means that the portfolio tends to diminish the portfolio sensitivity to the market as a whole. These variables provide a basic performance comparison:

	ETF Portfolio	Mutual Fund Portfolio
Average Annual Return	15.98%	15.85%
Standard Deviation in Annual Return	7.18%	6.89%
Total Yield	1.97%	2.23%
Beta	88.87%	85.48%

Three year historical statistics for the two portfolios

Over the past three years, these two portfolios have not produced identical results. The ETF portfolio has generated an average annual return that beats the mutual fund portfolio by 0.13% per year. The *Standard Deviation* in return for the ETF portfolio is also higher, however, which means that the ETF portfolio shows higher risk along with its higher return. The total yield of the ETF portfolio is lower than that of the mutual fund portfolio, which is not too surprising given that we have seen that an ETF such as IVV may invest up to 10% of its value in assets including cash and derivatives. The value of Beta for the ETF portfolio is also higher than for the fund portfolio, which shows that the ETF portfolio has a slightly higher level of systematic risk.

When we project forward into the future with *Quantext Portfolio Planner*, a Monte Carlo portfolio management tool, we obtain the following estimates of future average annual return and standard deviation in annual return for these two portfolios:

	ETF Portfolio	Mutual Fund Portfolio
Average Annual Return	9.17%	8.84%
Standard Deviation in Annual Return	13.99%	13.42%

Projected future average annual return and standard deviation in annual return

The projected future difference between the ETF portfolio and the Mutual Fund portfolio is larger than what we have seen in the last three years, but is still quite small.

Furthermore, this gain in average return is offset by a commensurate increase in total portfolio volatility. Note that this projected future performance accounts for differences in fees between the ETF's and mutual funds.

If you were invested in the portfolio of Vanguard mutual funds, it would be quite hard to argue that switching to the equivalent ETF portfolio makes sense. Further, there are uncertainties in the simulation and associated statistical parameters. These two portfolios are, indeed, essentially equivalent. This difference of 0.33% per year in projected returns shown here is only one tenth of the 3% per year by which the average equity fund has lagged the S&P500 over the last twenty years. That said, if you are starting from scratch

it would make sense to go with the ETF portfolio as long as your transaction fees are small enough that they do not overwhelm the 0.33% per year advantage.

Let's take one additional step and modify the mutual fund portfolio to have same level of historical risk as the ETF portfolio, as measured by Beta and Standard Deviation in Return:

Vanguard Fund	Modified Fund Allocation
VFINX	26%
VIMSX	19%
NAESX	5%
VDMIX	20%
VEIEX	5%
VBISX	10%
VBIIX	5%
VBLTX	5%
VGSIX	5%

Modified Mutual Fund Portfolio

This portfolio exhibits historical performance that is more similar to the ETF portfolio and matches the standard deviation in return perfectly:

	ETF Portfolio	Modified Mutual Fund Portfolio
Average Annual Return	15.98%	16.63%
Standard Deviation in Annual Return	7.18%	7.18%
Total Yield	1.97%	2.17%
Beta	88.87%	88.17%

Three year historical statistics for the ETF portfolio and the modified Vanguard portfolio

We have adjusted the allocation by market capitalization to achieve this risk matching between the funds. This modified portfolio has substantially less in large caps (VFINX) and more in mid caps (VIMSX). The result is that historical risk, as measured by Beta and Standard Deviation, is essentially identical in both portfolios but the average historical return of the mutual fund portfolio is 0.65% per year better than that of the ETF portfolio.

While these portfolios look very similar on the basis of recent performance, *Quantext Portfolio Planner* raises one important issue. Total portfolio diversification, as measured by our Diversification Metric, is slightly less for the modified mutual fund portfolio (DM=36%) than for the original mutual fund portfolio and ETF portfolio (both equal to 38%). This means that the risks across asset classes are not offset as efficiently in the modified portfolio as in the original portfolio. For more information on measuring total portfolio diversification effects, see our paper called *Accounting for Total Portfolio Diversification* (link at end of this paper).

Does the higher historical average return on the modified mutual fund portfolio mean that I prefer this mutual fund portfolio over the model ETF portfolio? To address this question, we must look beyond historical performance. We know that the future will not look just like the past—especially the recent past—and this is why people use Monte Carlo models such as *Quantext Portfolio Planner*. When we compare the Monte Carlo projections for the original ETF portfolio vs. the modified mutual fund portfolio, we get the following results:

	ETF Portfolio	Modified Mutual Fund Portfolio
Average Annual Return	9.17%	9.04%
Standard Deviation in Annual Return	13.99%	13.85%

Projected future average annual return and standard deviation in annual return

The projected future results suggest that the relative out-performance of mid-caps relative to large-caps in the recent three years is an anomaly and will tend to be balanced out in the future. The projected returns for the mutual fund portfolio are now 0.13% per year

less than that for the ETF portfolio. The projected standard deviation in annual return for the mutual fund portfolio is also slightly lower than that for the ETF portfolio. This result makes intuitive as well as quantitative sense.

I noted earlier that the average equity mutual fund has lagged the market as a whole by 3% per year, largely due to fees. Sadly, the average mutual fund investor's returns have lagged the market as a whole by an additional 3% per year—largely due to failed attempts to time the market. This loss of three percent per year accrues because many investors make decisions based on choosing a portfolio that has recently outperformed historical results rather than a reasonable projection. On an historical basis, the modified mutual fund portfolio generates higher return for the same risk but in the Monte Carlo projections the ETF portfolio looks preferable. I feel that one of the most valuable uses of *Quantext Portfolio Planner* is to discount recent performance of asset classes to some extent in favor of the long-term balance between risk and return in the capital markets. It simply does not make sense that allocating more to mid caps should provide a gain in risk-adjusted return over the long-term, even though this has been the case over the past several years.

So, it turns out that the two portfolios that we started with—one built from ETF's and one built from Vanguard index funds—are essentially equivalent to one another. An attempt to tune the mutual fund portfolio to get a little additional return while matching historical risk of the ETF portfolio looks good over the past three years but looks unattractive when we run the forward looking Monte Carlo projection. As investors consider moving between fund families or from mutual funds to ETF's, Monte Carlo analysis can help to show how one portfolio ultimately differs from another.

Links:

The Radical Guide to Investing

http://www.radicalguides.com/2005/06/the_radical_gui.html

John Bogle paper with mutual fund statistics

http://www.vanguard.com/bogle_site/sp20060208.htm

Accounting for Total Portfolio Diversification

<http://www.quantext.com/TrueDiversification.pdf>

More information on Quantext Portfolio Planner and instructions for obtaining a trial copy can be obtained at <http://www.Quantext.com>