

The last several weeks have served as a wakeup call to many investors that market risk can increase quickly. The more fundamental point is that market volatility (i.e. risk) has been running at roughly half of historical levels for the last several years. This is not uncommon in the aftermath of a long bull rally and the subsequent decline. See this discussion for more details:

<http://etfinvestor.com/article/11098>

For a nice and simple visualization of how low market volatility has been in the past several years as compared to historical norms, see this recent article by Eddy Elfenbein:

<http://usmarket.seekingalpha.com/article/10942>

There are major cycles in market volatility and we are poised to see sustained increases in overall market volatility. You don't need to take my word for it though. There are two major factors that suggest increasing market volatility. First is that market volatility tends to revert to its long-term average over extended periods of time and we have been running well below this level for quite a while. Second, long dated options on the S&P500 and on the NASDAQ100 have implied volatility that is consistent with a marked increase in market volatility over the next couple of years:

<http://etfinvestor.com/article/6098>

While the options markets have been signaling this possibility, many investors do not really understand how a marked change in market volatility can impact their portfolios.

The simplest way to project the behavior of a portfolio in a higher-volatility environment is by using Monte Carlo simulation. In fact, if you read my earlier articles expressing concern over the high risk potential in emerging markets, you will see that we were accounting for the fact that market volatility would increase and that this effect had implications for emerging markets. As market volatility increases, the total risk in your

asset allocation will change with it, and this is a function of your portfolio Beta and R^2 , as well as your portfolio's total volatility. These effects can be major and it is my feeling that many investors whose portfolios have exhibited fairly low volatility over the past several years are in for a mighty shock as the market becomes more active going forward. Market volatility feels a bit like seismic activity to many investors—you may forget that you live in an earthquake zone if nothing bad has happened for a while, but a solid shock can bring that fact back into focus. We have had a precursor of that kind of shock in the last weeks. This volatility will not be going away in the medium to long term.

You can easily track current market volatility using VIX (^VIX) on Yahoo! Finance or your charting source.

Let's take a look at how increasing market volatility can impact the projected risk in a portfolio of ETF's. I have used the simplified universe of ETF's below in a number of articles:

Ticker	Style
IVV	S&P500
IJJ	Mid-Cap Value
IWN	Small Value
EFA	Foreign Large Blend
IEV	Europe Stock
EWS	Pac/Asia ex-Japan
IYH	US Healthcare
IDU	US Utilities
SHY	Short Gov. Bond
TLT	Long Gov. Bond

Simplified universe of investments using iShares ETF's

We have started by building a portfolio that has performed quite well over the past several years (below). This portfolio is also projected forward using our Monte Carlo portfolio planner using the assumption (for the moment) that future volatility in the broader market will be similar to what we have seen over the past three years.

			Portfolio Stats	
Fund Name	Percentage of Funds	Average Annual Return	Average Annual Return	Standard Deviation(Annual)
IVV	15.0%	8.32%	9.58%	8.46%
IJJ	15.0%	10.08%		
IWN	10.0%	11.25%		
EFA	5.0%	9.82%	Historical Data	
IEV	5.0%	9.84%	Start:	End:
EWS	10.0%	9.93%	5/1/2003	4/30/2006
IYH	10.0%	9.15%	Average Annual Return	Standard Deviation (Annual)
IDU	10.0%	9.50%	17.66%	7.40%
RWR	10.0%	12.92%	Historical Beta: 87.41%	
SHY	5.0%	5.35%	Historical Yield: 2.36%	
TLT	5.0%	6.33%		
-	0.0%	-		
-	0.0%	-		
-	0.0%	-		
-	0.0%	-	Performance of S&P500 over historical period	
-	0.0%	-	Average Annual Return on S&P500	
-	0.0%	-	10.86%	
-	0.0%	-	Annual Standard Deviation on S&P500	
-	0.0%	-	7.45%	
-	0.0%	-		
Sums to	100.0%			
Simulated Portfolio Beta 87.41%			Market Index (S&P500)	
			Average Annual Return	Standard Deviation (Annual)
Diversification Metric: 37%			8.30%	7.54%

Historical and projected portfolio performance assuming future market volatility equals last three years

This portfolio has generated an average annual return of 17.66% per year, with a standard deviation of 7.40% over the past three years. This is a very high return relative to volatility and we know from long-term historical studies that this high a return relative to the level of volatility cannot be sustained. As a rule of thumb, it is unlikely to see any portfolio that has a ratio of average return to standard deviation in return greater than 1.0 for long periods of time. The S&P500 averages about 2/3 for this ratio. With good use of portfolio diversification effects it is possible to get fairly high ratios here. We have

assumed that the future average annual return for the S&P500 is 8.3% a year, a reasonable estimate. That said, this assumed average annual return compared to the standard deviation in annual return for the S&P500 (7.54% as above) yields a ratio greater than 1.0, but we will go with that for now. This model portfolio (above) has a projected average annual return of 9.58% with a standard deviation (SD) of 8.46% (see *Portfolio Stats* above). This ratio of average return to SD is too high to be reasonable, but it is a lot lower than what we have seen over the past several years (see *Historical Data* table above). From this starting point, if we wish to assume future average annual return of 8.3% per year, the assumed volatility as measured by SD of the S&P500 is so low that we would have to assume that the market will yield higher risk adjusted returns than it ever has for extended periods of time. The market has been yielding high risk-adjusted returns for the past several years but it would be a bad idea to assume that this situation will persist.

The portfolio shown above is a fairly reasonable one—with Beta of 87.4% and a total yield of 2.36% per year. Further, the allocations are such that the non-market components of return are reasonably uncorrelated—as reflected by a 37% value for the Diversification Metric. The Diversification Metric measures the real diversification in the portion of portfolio return that is not explained by the returns on the S&P500 (i.e. non-Beta effects). The Beta level shows that this portfolio will be fairly sensitive to increases in market volatility. To make this more concrete, let's look at the one-year projected returns for this model portfolio:

Percentile	Portfolio Value	Gain / Loss	Return
1%	\$90,739	-\$9,261	-9%
5%	\$95,391	-\$4,609	-5%
10%	\$98,434	-\$1,566	-2%
15%	\$100,607	\$607	1%
20%	\$102,426	\$2,426	2%
25%	\$103,659	\$3,659	4%
30%	\$105,101	\$5,101	5%
35%	\$106,514	\$6,514	7%
40%	\$107,539	\$7,539	8%
45%	\$108,656	\$8,656	9%
50%	\$109,742	\$9,742	10%

One-year projected performance of a \$100K portfolio using market volatility over the past three years

These results show that while the median one-year return is about 10%, there is a 5% chance of losing 5% or more of your portfolio's value (the 5% percentile). This is a very moderate level of risk for a portfolio that is 90% invested in equities. Even though this portfolio is 90% equities, this is a conservative portfolio in terms of the total risk level. This portfolio only suffers a loss in between 10% and 15% of years—one of out of every 8-10 years (see the 10% and 15% percentiles above). These results show what we might expect in the future from this portfolio if the S&P500 stays at the levels of volatility that we have experienced over the past few years.

Now let's look at the projected performance of this portfolio under the assumption that the volatility of the S&P500 reverts to its long-term average value, with standard deviation in annual return (SD) of 15.07%. This level of volatility is slightly more than twice the level we have been experiencing over the past several years. This projected future level of volatility is also reflected in the price at which long-dated options are trading for the S&P500. When we change this single variable in our projections, we obtain the Monte Carlo projection shown below. The effect of our change in projected volatility for the S&P500 is seen most prominently in the projected future standard deviation in annual return on this portfolio (*Portfolio Stats* below). The projected standard deviation in annual return is 15.8% per year, dramatically higher than the 8.46% we obtained from the previous simulation. The higher volatility is driven by the fact that

we have a portfolio Beta of 87.4% and the projected standard deviation of the S&P500 has doubled over the recent three years.

			Portfolio Stats	
Fund Name	Percentage of Funds	Average Annual Return	Average Annual Return	Standard Deviation(Annual)
IVV	15.0%	8.35%	10.00%	15.80%
IJJ	15.0%	10.77%		
IWN	10.0%	12.07%		
EFA	5.0%	8.76%	Historical Data	
IEV	5.0%	8.83%	Start:	End:
EWS	10.0%	7.29%	5/1/2003	4/30/2006
IYH	10.0%	10.00%	Average Annual Return	Standard Deviation (Annual)
IDU	10.0%	10.69%	17.66%	7.40%
RWR	10.0%	17.54%	Historical Beta: 87.41%	
SHY	5.0%	2.41%	Historical Yield: 2.36%	
TLT	5.0%	8.35%		
-	0.0%	-		
-	0.0%	-		
-	0.0%	-		
-	0.0%	-	Performance of S&P500 over historical period	
-	0.0%	-	Average Annual Return on S&P500	
-	0.0%	-	10.86%	
-	0.0%	-	Annual Standard Deviation on S&P500	
-	0.0%	-	7.45%	
-	0.0%	-		
Sums to	100.0%			
			Market Index (S&P500)	
Simulated Portfolio Beta 87.41%			Average Annual Return	Standard Deviation (Annual)
			8.30%	15.07%
Diversification Metric: 37%				

Historical and projected portfolio performance assuming future market volatility equals long-term average value

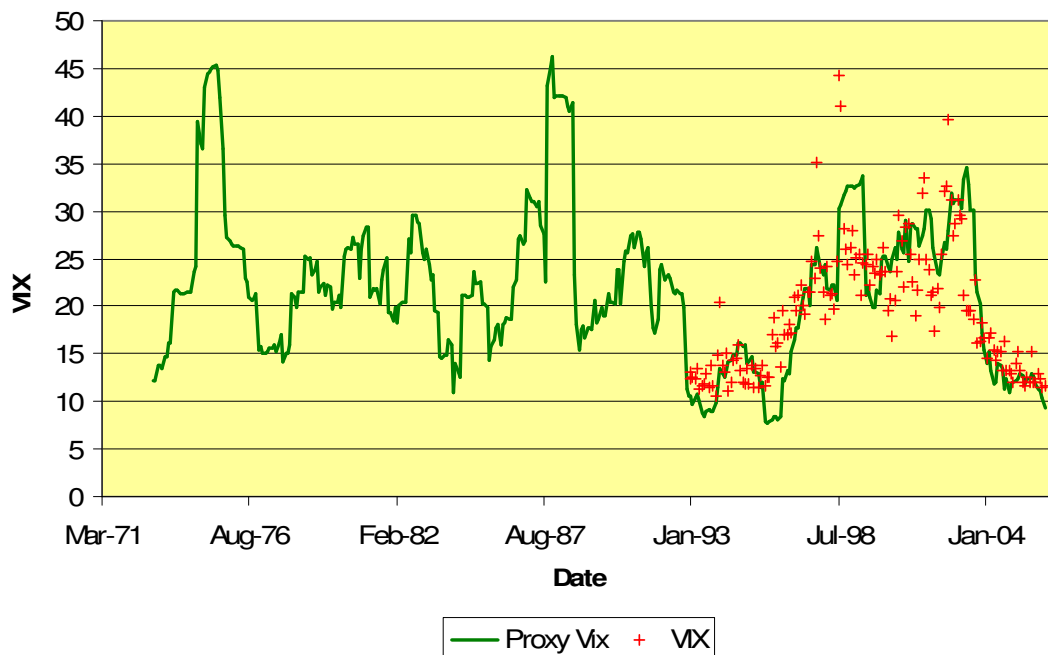
Okay, so the standard deviation in annual return is considerably higher. Let's now look at what that means as far as the potential for loss over a one-year period (below). This portfolio is now projected to have a 5% chance of losing 17% or more in a single year

(the 5% percentile below). Further, this portfolio will lose money in 25%-30% of years. This means one out of every three to four years will lose money (look at the 25% and 30% percentiles below).

Percentile	Portfolio Value	Gain / Loss	Return
1%	\$74,797	-\$25,203	-25%
5%	\$83,490	-\$16,510	-17%
10%	\$89,178	-\$10,822	-11%
15%	\$93,238	-\$6,762	-7%
20%	\$96,639	-\$3,361	-3%
25%	\$98,942	-\$1,058	-1%
30%	\$101,637	\$1,637	2%
35%	\$104,279	\$4,279	4%
40%	\$106,192	\$6,192	6%
45%	\$108,280	\$8,280	8%
50%	\$110,311	\$10,311	10%

One-year projected performance of a \$100K portfolio using historical average market volatility

Clearly, there is a dramatic increase in the risk level of this model portfolio if the volatility of the S&P500 reverts to its historical average and odds are that it will. I believe this because the long-dated options on the S&P500 suggest a substantial increase in standard deviation in returns, as noted earlier, but also by a review of historical levels of market volatility. History shows that the standard deviation in annual return on the market as a whole tends to range around a fairly stable long-term average (below) and we are well below that level.



Historical VIX and proxy for VIX using SD of annual return on S&P500

The CBOE’s Volatility Index (VIX) tracks trailing 12-month standard deviation in return on the S&P500 (above), but the VIX goes back only to 1993. We can use trailing SD in annual return to look further back (Proxy VIX). We are currently near historical lows for volatility in the S&P500---it has nowhere to go but upwards in the medium to long-term. I am concerned that many people do not understand how an increase in broader market volatility will increase the volatility (i.e. risk) in their portfolios. In the model portfolio shown here, a reversion of volatility in the S&P500 from recent levels to its historical average dramatically increases the probability of a substantial drawdown in value in any given year. The portfolio has stayed the same, but the market that drives the portfolio can change. Our model portfolio becomes far riskier if market volatility simply returns to its historical average. If market volatility swings above average, as it has for substantial periods of time, the model portfolio will be very risky.

The punchline of this article is that finding the proper risk-return balance for your portfolio is a function of your investing horizon and what we assume about future market volatility. For the long-term investor, it will be sufficient to plan based on using long-

term statistics for market volatility. It is very important, however, for the long-term investor not to assume that the low volatility that we have seen over the past few years will persist. Planning on this basis will leave many investors with much riskier portfolios than they want. For portfolio planning on shorter time horizons, it will be a good idea to consider how your portfolio will fare in an environment of increasing market volatility. Can you handle the larger swings that increases in market volatility will bring? There is always a temptation for investors to assume that recent conditions will persist—and this applies to assumptions about market risk. During extended periods of low volatility in the broader market, many investors tend to invest more aggressively. This behavior can lead to shocking losses when market volatility returns to historical levels.

More information on Quantext Monte Carlo planning tools, as well as a free trial, is available at: <http://www.quantext.com/gpage3.html>