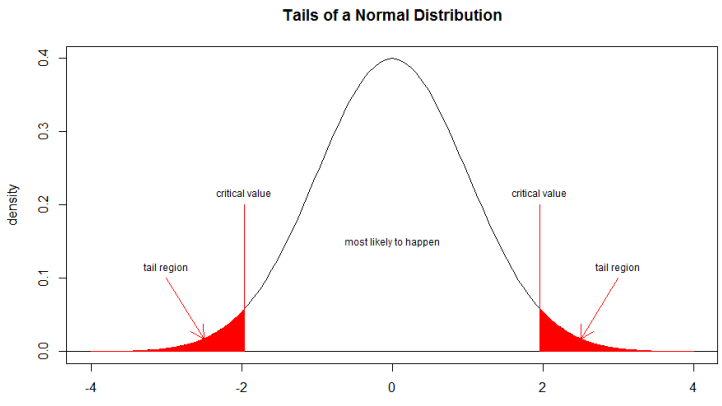
CHASEFIELD | CAPITAL

Harold Pine
Managing Director

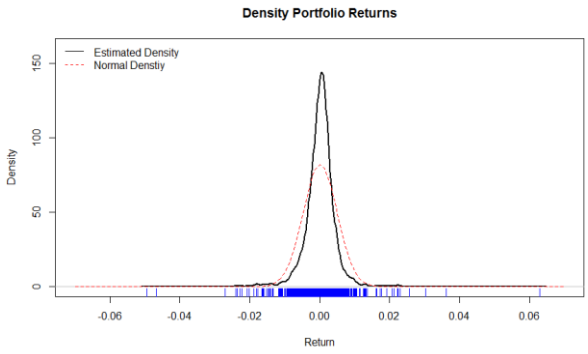
Is the Tail Wagging the Dog?

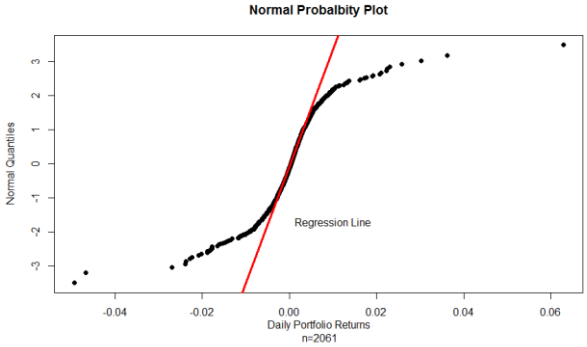
" Tail Risk in Portfolio Construction"

As Recent events demonstrate, the impact of tail risk can effect your portfolio. What is tail risk? In its simplest form, tail risk is what is least likely to happen to you regarding returns on any given day, month or year. The longer you are in the markets the more likely you are to experience a tail event (2008-2009). If returns follow a normal distribtuion, then 10% of the time it looks like below. The red shaded area is how often you would experience tail returns if, in fact, returns were normally distributed. Notice both bad (left) and good (right) tail events.



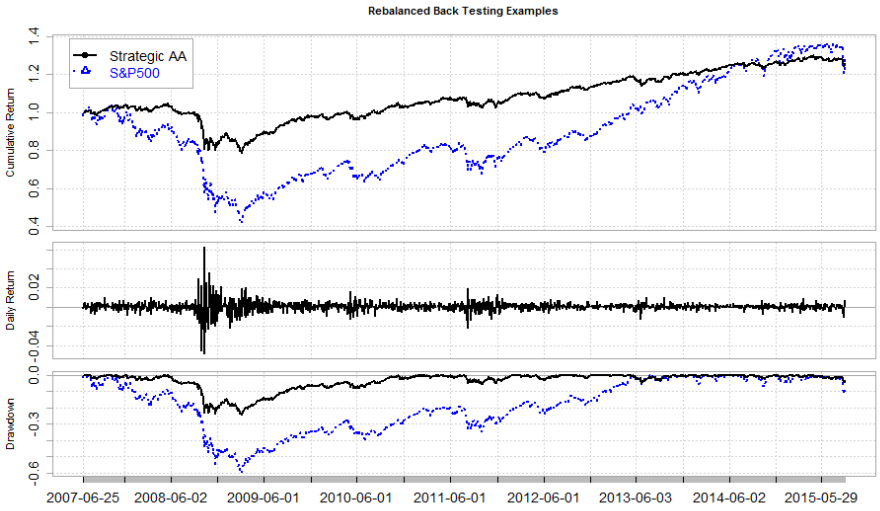
Below are what portfolio returns actually look like from a non-parametric view point for a moderately aggressive portfolio. That is a fancy term for the actual returns as opposed to returns that are fit by an equation or model. You can see that we fit a normal distribution curve (dashed line on left graph) over the actual portfolio returns. Actual returns have a much bigger peak and fatter tails. Taking another look via the normal probability plot below you can also observe that many returns do not fall on the red normal regression line.





It is pretty clear that returns are not normally distributed. What does that mean to you as an investor? Well when you see a presentation on investment portfolios, you should ask how they are modeling returns. Most likely they are using a standard normal probability density function. This may provide you an inadequate view of how your portfolio might behave. In portfolio construction, a reasonable investor can withstand day-to-day fluctuations. If not, then you need to think about some other issues surrounding your investment policy statement. However, a certain percentage of time returns fluctuate to a much larger degree. We call this a turbulent regime. In other words, volatility is not constant and this is the point that we want to make. Most portfolio modeling is done under this condition of constant volatility.

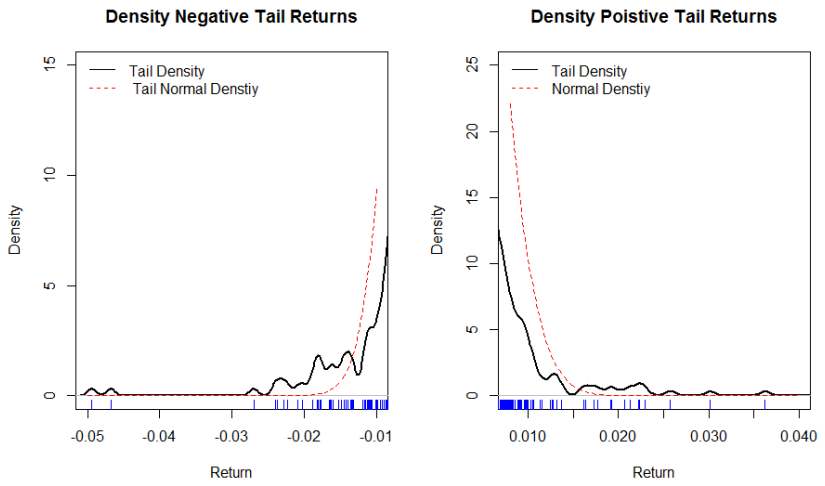
So how do we account for this? There are more than a few ways but we will only consider a couple for the sake of simplicity and brevity. First, we can model the distribution of returns using various techniques to give us a forecast of what to expect in the future. This is called fitting the distribution of returns to some parametric function. We can use the standard normal distribution and make forecasts based on that. Not a great idea but simple and used regularly by some very well know firms! Second, we can consider historical returns and use that as a guide to predict returns. If we have a large enough sample, this might be pretty good. We have to capture both normal and turbulent regimes in this sample. Lucky for us we have 2008-2009 to get a good representation!



We actually ran what a moderately aggressive portfolio looks like since 2007 versus the S & P 500. This is a strategic asset allocation that represents about 56% equites, 16% alternatives and 28% fixed income. As you can see, the daily returns from 2007- 2015 are not constant (middle graph). This whole graph actually has some built in characteristics we find interesting and relates to our process of rebalancing but we'll leave for another time. Notice during 2008 -2009 time

frame, the drawdown for this account is 25% versus 40% for stocks. Also, this account was not surpassed in returns until late 2014. This is why managing risk matters. When volatility is low (2012 until now), people forget that large drawdowns take a long time to recover their original values.

So what really happens in the tails? You can observe below that it is much bumpier than the smooth dashed line that represents the normal distribution. That means events are happening there more often than would be predicted by the normal distribution. We also want to point out the tails are not equal. A lot more events take place beyond -1% than +1% in tails (blue rug). If you were to use a normal distribution, you might not get a full representation of what you might experience over long periods of time. We can provide you some numbers but for simplicity sake you are almost 53 million times more likely to experience a six sigma event if returns fit a "t" distribution than a normal distribution! That's bad if you are not aware of this at the outset. Investors are more likely to stay with their plan if they are aware of the issues than if not. A poor understanding of these potential big events may lead to an inconsistent approach to your plan. That is a nice way of saying you might make an emotional decision as opposed to a rational well thought-out one.



Conclusion

Let's wrap things up by seeing how this might look if someone presented you this data using a normal distribution versus what has actually happened. We also want to tie this in as to why when creating your investment policy statement (IPS) you should consider these rare events. A properly prepared IPS should account for your ability to emotionally handle tail events. This is assuming that they have been properly estimated and identified!

We did a little modeling and turned this non-normal distribution in to a normal one. This was accomplished by applying the same average daily return and same standard deviation to a random normal model and then estimating expected tail loss from both the normal and actual distribution.

Here are the results:

The average daily return over our time frame is:

0.000121 at an annual rate of about 2.5%.

Don't get too caught up on the low portfolio return. Remember this portfolio was started in 2007 (not a great time to start) and is just an example. Anyway, we are talking about risk. What better period is there to talk about risk than the 2008 credit crisis!

So what about the risk of this portfolio? Well this portfolio has a daily standard deviation of:

0.004859 at a yearly standard deviation of 7.7129%.

To put all this in to context for an investor you would expect that your portfolio's:

Annual return is about 2.5% with annual fluctuations of plus or minus 7.71% two-thirds of the time.

So in other words your portfolio would return between -5.21% and 10.21% two-thirds of the time. You have probably heard this before in your discussions with investment professionals.

You say great but what you really want to know is how bad can this portfolio can get! Well let's take a little liberty with some quantitative tools and interpretations to simplify things even a bit more. We would say that your value-at-risk at the 5% level is -12.5%. This means that 95% of the time your portfolio will do better than this but 5% of the time it will be worse. How much worse? Well that is the magic question!

If you're presented with a normal distribution versus the actual, you might be unintentionally misled. Once you have surpassed the -12.5%, your expected loss is -15% (using the normal distribution) when in reality is more like -18%. This is assuming they know how to do expected tail loss.

Let me say this one more time. Once you reach the -12.5%, you would expect that on average your loss would be -18%. That basically is what is happening in the last 5% of the left tail.

Congratulations you now will be able to tell someone that when the Basel III accords come out you know exactly what "Expected Tail Loss" (ETL) is and that "Value-At-Risk" is passé. Not really but ETL is better.
