Quantitative Analyses or Representations That May be Flawed In Their Methodology:

Standard Deviation More Commonly Referred to as Volatility Might Paint A Skewed Picture.

By Cobus Kruger: Director International Investment: TriAlpha Group addresses the above issues.

Everyday investors face the fundamental question of whether they are being sufficiently rewarded for the risk they take. The so-called Modern Portfolio Theory (MPT) provides a relatively simple framework to generate a possible answer to this, i.e. the concept of portfolio optimisation. Assuming that investors are risk-averse they always choose the less risky option if expected returns are equal or demands higher compensation to take on additional risk. This implies that if for a given portfolio another one with a superior risk-return profile exists, a rational investor would always invest in the latter one.

A standard measure of risk is the second moment of the distribution of a variable. In this case our variables are the returns of an investment. If a given number of realisations for this variable are put together in a histogram, basically showing how often certain realisations occurred, one can derive certain statistical properties. Within the scope of MPT, the most important properties to assess the risk/return profile of an investment of a portfolio are the average realisation or arithmetic mean of the returns (first moment of the distribution) and their average deviation from this mean or the standard deviation (second moment of the distribution).

One of the central criticisms of portfolio optimisation can be found in the original model developed by Harry M. Markowitz in the 1950s. He used expected returns and future variances but this unfortunately falls short when specifying how such values can be derived. Therefore practitioners estimate them from historic values. In light of this it can be argued that the choice of the look-back period therefore becomes crucial as a time series covering a very volatile period (for instance Q4 of 2008) leads to larger numbers for standard deviation.

To give an example, assume you have the choice between two securities: Security X historically returned 2% per month with a standard-deviation of monthly returns (“risk”) of 3%, while Security Y returned 2% per month with a standard-deviation of monthly returns of 4%. A rational investor decides that Security X is the better choice, because it offers the same “expected” return but single realisations are on average not dispersing as much around this mean as the returns for Security Y.

Mathematically standard deviation can be interpreted as the square root of the average quadratic deviation of a variable from its expected value. In this case, for each of the data points contained in the look-back period, the expected return (average return over this period) has to be subtracted and the resulting difference squared. All squared differences are summed-up and divided by the number of data points less one. This returns the variance of an investment. Finally taking the square-root of the variance returns the standard deviation for the specific period. Usually the standard deviation is also shown as an annualized number (i.e. multiplied with the square-root of the time period, for instance square-root of twelve if monthly data-points are used) and commonly referred to as volatility.

What sounds pretty straight forward in theory unfortunately can become quite problematic in the real world. As recent market turmoil impressively demonstrated, past risk and return is not always an indicator for what investors should expect. Not only can preceding periods of low volatility distort the information in standard deviations (see above) but more importantly, distributions are not fully specified by the first two moments. To be able to understand the past behaviour of a variable one has to take into account the symmetry of realisations above and below the mean (Skewness or third moment of a distribution) and the "peakedness" of the return distribution (Kurtosis or fourth moment of a distribution). Both carry important data about whether large deviations from the mean are relatively frequent and can therefore be used when assessing the probability of "extreme events".

Another important point to note is the use of observable data when presenting a specific concept. Although this sounds quite trivial on the surface, it is something that cannot always be adhered to owing to the fact that data across the asset class spectrum is not always readily available. As some investors painfully experienced, historic measures of risk are useless if an investment becomes illiquid. Whatever number is assumed to represent risk, measured by the standard deviation, then has nothing to do with real price moves. Such assets, namely physical property, private equity and the infamous structured products, can be referred to as being implicitly "short volatility". This simply means that pricing for such securities crucially depends on the assumption that relevant markets are working properly and no external price shocks occur. As soon as markets are disrupted, resulting uncertainty normally leads to larger or even extreme price moves, i.e. larger deviations of the returns in general from their historic means. It is just these market environments of increased volatility when investors in the products mentioned suffer huge losses (if a price is available at all).

Clearly, this isn't captured by standard deviations. Consequently an investor who solely relies on historic means and standard deviations is taken by surprise if an asset which is supposed to deliver relatively constant return all of a sudden is down by double-digits. While unfortunately there's no real solution to the assessment of such extreme events from an ex ante perspective, there are some rules of thumb that investors might decide to follow: Firstly, whether they want to modify the use of standard deviations, for example by comparing so-called upside volatility, i.e. the standard deviation of positive returns, with so-called downside volatility, i.e. the standard deviation of negative returns. Secondly, whether the concept of a cubic utility function, i.e. the full description of the investor's preference by expected risk and return, really is sufficient or if the third and fourth moments of a distribution should be taken into account. And thirdly, whether they want to base their investment decisions solely on historic returns as opposed to, for example, expected returns derived from a scenario analysis. And, of course, finally a decision to invest in a specific asset class is always a multi- dimensional decision and should not be made purely on quantitative assessments.

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