Tactical Asset Selector

Why standard deviation won't serve to classify the risk of a portfolio

As the screw of regulatory compliance turns and tightens, investment managers will be obliged to spend increased time and resources explaining and reporting portfolio risks to their clients and the regulatory authorities. The task will be expensive and endless, as the concept of riskiness is multi-faceted and deep.

There is already a huge technical literature on the subject of investment risk, and a brief commentary cannot begin to do justice to it. Instead, this report simply reviews some important reasons why investment managers and their regulators should not rely on standard deviation when they assess the riskiness of investment products. Though enshrined in tradition, it's a statistic just simple enough to get people into trouble.

The standard deviation of periodic returns (typically, monthly or annual returns) is an essential ingredient in analyzing the riskiness of an investment. It is very useful and easy to compute. But it is far from a statistic which investors can thoughtlessly use to gauge the risk or vulnerability to which they expose themselves when purchasing debt or equity in a company, commodity or fund. And it is certainly not scientifically authoritative. There are many ways, well known to analysts, in which standard deviation may produce an irrelevant or misleading impression of the risk assumed when an asset is purchased.

Standard deviation is a measure of the volatility of a price, a price index, or

> *Risk is a multi-dimensional concept, with complexities that can lead to confusion.*[1]

an index of total return: that is, the statistical variation around the mean percentage change. Volatility itself is one element of "risk," but often only a subsidiary one. However, before addressing whether volatility is the right concept for regulators to center on, we begin by pointing out that standard deviation is not even a general-purpose measure of volatility.

"Tail risk" and downside *versus* upside volatility. Volatility is a measure of how far performance strays from its own average. But it goes without saying that investors care a great deal whether most of the straying tends to occur on the upside or the downside, and whether extreme divergence from the average is frequent or rare.

If investment returns followed the normal (Gaussian) distribution there would be no issue. In that unique case, all relevant information about volatility is summarized in the standard deviation statistic. But *none of them do*. At a minimum, there is a mathematical difference between the real world of investment returns and the theoretical world of the normal distribution. While unleveraged returns from an asset offer a maximum

possible loss of 100 percent, the normal distribution stretches to infinity both above and below the mean. Typical distributions of investment returns have tails that are "fat" relative to the normal distribution.

Even holding the standard deviation constant, the more frequently returns stray far away from their average, the fatter the tails and the riskier the investment. Statistics such as semi-variance and the Sortino ratio are available for the purpose of making these distinctions.

Tail risk is clearly much more of a deterrent for investors if it occurs on the downside rather than being evenly distributed between the downside and the upside. The standard deviation tells us nothing about that. One example of an investment whose value is subject to occasional plunges but otherwise advances at a relatively predictable pace is a portfolio of high-yield bonds.[2] The VIX index of stock-market volatility illustrates the opposite example of a distribution whose tail risk is primarily on the upside, with very limited scope for divergence below the average on the downside.

In sum, investors need to consider the shape of the entire distribution of returns from an asset in order to assess its risk. Standard deviation will be sufficient only where the distribution is "nearly" normal, whatever that means. Regulators cannot do their job without digging into these questions.

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1. Ronald W. Kaiser and Jim Clayton, "Assessing and Managing Risk in Institutional Real Estate Investing," originally published in the *Journal of Real Estate Portfolio Management*, and reprinted by the Chartered Alternative Investment Analyst Association in its educational materials.
2. See "A trading-rule test of risk bets in high-yield debt," *Interest-Rate Outlook*, H. C. Wainwright & Co. Economics Inc., March 23, 2012.

Volatility *versus* vulnerability: covariance and "stand-alone" volatility. The ultimate purpose of assessing the risk of an investment is not to classify that asset as intrinsically healthy or unhealthy, but to warn the investor of his vulnerability. The "stand-alone" volatility of the investment is not a measure of that. The increase (or reduction) in the investor's vulnerability is measured by what the investment adds to (or subtracts from) the investor's overall volatility. That, in turn, is a function of the assets that he already owns—which, of course vary from individual to individual. So the risk of an investment cannot be "dumbed down" to any statistic such as standard deviation, or to any classification such as high, medium or low.

That is also why the risk of an investment is a function of its covariance (or correlation) with other assets, and not merely its "stand-alone" volatility. A typical investor whose tradeable assets consist mostly of equities and cash will make himself more vulnerable if he uses some of that cash to buy more equities, or if he switches some of his defensive (low-volatility) stocks into aggressive (high-volatility) stocks. For that investor, any investment fund consisting of stocks or assets that are positively correlated with stocks (such as high-yield bonds) should be classified as high risk.

Cash is placed relatively low on the risk scale—but not simply because it has low volatility. Rather, it is because selling equities and holding the proceeds in cash will reduce the typical equity-cash investor's overall volatility. If he diversifies his portfolio to include an asset which is roughly uncorrelated with stocks (such as investment-grade bonds) or has an inverse correlation with stocks (such as gold), he will tend to *lower* his overall risk—regardless of the volatility of the investment itself.

The concept of stand-alone risk therefore applies only (if at all) to investments *within* a class of assets that are closely and positively correlated with one another. It can be highly misleading across asset-class boundaries. From the viewpoint of an equity-cash investor, investment-grade bonds are a low-risk investment. But gold, with its inverse correlation to stocks, is lower risk still. In this sense, the risk of a gold investment may well be *negative*.

Nominal *versus* real risk. Finally, and strangest of all, a hypothetical investment which had a zero standard deviation would not necessarily be in the least safe. That depends on the unit of measurement used to express investment return.[3]

At one time, decades in the past, the US dollar represented a stable unit of measurement, because it was defined in the past as a fixed quantity of (and was convertible into) gold. The distinction between nominal risk and real risk did not exist. That is no longer true. An investment with a stable return measured in dollars (a low standard deviation) would be highly unsafe in a climate in which the dollar was depreciating rapidly. An investment with an unstable return measured in dollars, like gold, could be highly stable in real terms.

Over the long haul, especially in countries whose currencies are unstable, the price of gold rises at the same rate as does the cost of living (after a delay), while it is highly uncertain whether the return on cash will keep pace.

Investment conclusion. The riskiness of an investment product cannot be represented by the standard deviation (volatility) of its historical returns, or by any other single statistic. Even in the extreme case of a zero standard deviation, an investment is risky if the monetary unit in which returns are expressed has variable purchasing power, especially if it depreciates. On a real risk scale, cash could be assessed as risky and gold as safe.

Assuming for the sake of argument that there were no currency risk, volatility is still not the only (or even the most important) aspect of risk to consider. An investor who places part of his wealth in an investment product which is inversely correlated with stocks and bonds or other assets that the investor already owns, *subtracts* from the overall risk borne by that investor. In this very real sense, if the correlation is sufficiently inverse, such an investment product would have negative risk! More generally, the purchase of an investment product may either increase or diminish the overall risk borne by the investor, but the impact depends more on its covariance with other assets than it does on its volatility.

Even within the limited aspect of risk that volatility represents, standard deviation will still frequently fail to be a satisfactory measure. Only in the rare special case where investment returns approximate a normal distribution does it fill the bill. In practice, frequency distributions have fat tails—that is, a disproportionately large tendency for exceptionally negative or positive returns. Some distributions may have a standard deviation that can be estimated from historical data, while in other cases the standard deviation is not finite, or so large as to be impossible to estimate.

Furthermore, the distributions of returns encountered in real life are often unsymmetrical (skewed) in multiple possible ways. A very common example is the case where upside volatility is substantially different from downside volatility. Any investor will rightly regard an investment where the downside is substantially greater than the upside as far riskier than one where the reverse is the case. The standard deviation is incapable of revealing any of these aspects of risk.

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3. "Cash is not 'really' the risk-free asset," *The Capitalist Perspective*, Wainwright Economics, April 30, 2005.