

# Some Rudimentary Thoughts About Risk Measurement in a Simplistic Portfolio

A couple of thoughts on risk...

In a portfolio consisting of assets of varying complexity, liquidity and aggregation structures (such as mutual funds, structured credit and structured products), the problem of risk measurement and management becomes a bit more complex.

## Instantaneous and econometric risk:

Econometric risk is the risk measured by the historical time series of the portfolio over time. It is relevant particularly where the portfolio contains mutual funds with varying liquidity terms which limit the investor's ability to alter the portfolio in real time. The risk here is that of the fund manager's ability to alter the risk profile of the component fund hence confounding instantaneous risk metrics. In this situation the econometric risk is a more useful metric for risk measurement as it internalizes the manager's behavior.

Instantaneous risk is a simple concept and is simply the risk to the portfolio at any single point in time. It is based on the instantaneous risk of the individual portfolio components and their interrelations (proxied by their correlations). Instantaneous risk is more relevant where managed products with lower liquidity are present and where the investor can immediately trade the portfolio.

The concepts of instantaneous and econometric risks cannot easily be unified into a single or simple measure. Portfolio risks are bests measured using both approaches separately as each provides different and useful insights to portfolio risk.

## A portfolio of mixed assets including liquid direct securities and liquidity constrained managed products:

While econometric risk is relevant to the managed product portion of the portfolio,

the mixture of self directed, advisory and discretionary strategies in a portfolio make econometric risk very hard to measure. An investor may make withdrawals or injections to the portfolio and without unitizing the portfolio for each unique investor's econometric risk is not measurable since there is no NAV time series to speak of. Instantaneous risk is more tractable for such portfolios, which incidentally are the mainstay or private client portfolios. We shall therefore focus on instantaneous risk.

We aim to describe as completely as we can the risks in a portfolio while maintaining as much parsimony as possible. Some risk methodologies attempt to reduce the risk metrics to a single parameter. This is not possible as there are several orthogonal risks and orthogonality by definition precludes linear combination without serious loss of information.

We begin with the convertible bond as it includes elements of equity, credit, duration and optionality in a single asset. A convertible bond's risk measures will include equity metrics such as delta and beta. It's bond metrics include yield(s), duration(s), spread(s), and convexity. It's option metrics include the usual Greeks such as gamma and vega. If one is so inclined, credit ratings may be included. A risk system capable of decomposing a convertible bond into its component risk metrics will be able to also handle equities and bonds and indeed most of the capital structure of a corporate or so sovereign security. The above metrics should therefore be available at the minimum. In the econometric risk domain, price history should be taken in and the usual moments calculated.

Aggregation vehicles introduce further challenges to the complete description of risk. In the simple case we have a mutual fund. Since the mutual fund may contain both equity and credit instruments, transparency is necessary to the underlying strategy, mandate or portfolio of the fund in question before it can be correctly decomposed in the risk system. This is usually but not always available. Here econometric metrics need to be used. Sophisticated systems may be able to decompose a fund by risk factors which can then be used to describe the instantaneous properties of the fund. The usefulness of such a scheme is not entirely clear. The risk metric frequency needs be no higher than the liquidity frequency of the fund since any output is not actionable in between dealing dates. We can deal with the varying dealing frequencies of the various different assets in a portfolio and adjust the moment estimates appropriately by borrowing from option implied volatility corrections for liquidity (the subject of another article.) Aggregation

vehicles such as asset backed securities and tranching securities will have more complex characteristics which may require augmentations.

Note that in our portfolio, each line item whether a single asset or an aggregation of assets such as a fund, the econometric metrics can and should be used to quantify the volatility and correlations across the portfolio. This is one of the few instances where econometric metrics imply instantaneous metrics. The accuracy and more importantly the validity of the estimators and the subjective adjustments thereto are crucial in arriving at useful portfolio implied moments.

Most risk systems focus on this area of risk as the reduction of risk the first four (implied) moments is very convenient. The implied moments are certainly useful summary metrics but are not a substitute for the orthogonal risk factors such as the Greeks. Both sets of metrics should be presented.

Note that implied moments are not entirely behavioural. They may be at the asset level but not at the portfolio level. This is the one instance when we pass from the econometric to the instantaneous and the resultant metric is most definitely instantaneous and not behavioural.