# VAR is not everything

This month, David Rowe responds to the letter from Andrew Aziz, published in the July issue of *Risk*, which asserts the benefits of multi-step Monte Carlo simulation versus scaling one-day VAR in estimating market risk over a longer period

First, I would like to say that Mr Aziz makes several good points. There are situations when multi-step simulation is a necessary and valuable tool. Two of these relate to the estimation of potential counterparty exposure. One is the simulation of potential exposure based on market values of trades at multiple future dates. A second is the potential cumulative gain (ie, counterparty loss) over a fixed time horizon, inclusive of gains on trades that mature prior to the end of the period in question. The latter is valuable for estimating margin requirements or, for a given level of collateral, the potential amount of uncollateralised exposure to a counterparty.

However, in both these examples the assumption of a static portfolio is realistic. We are interested in the risk implications of existing commitments played out against the range of likely future market conditions. There is no role for what was referred to, in my econometric modelling days, as an "endogenous response function". We have no need to adjust the simulation results for behavioural reactions to the simulated events as they unfold.

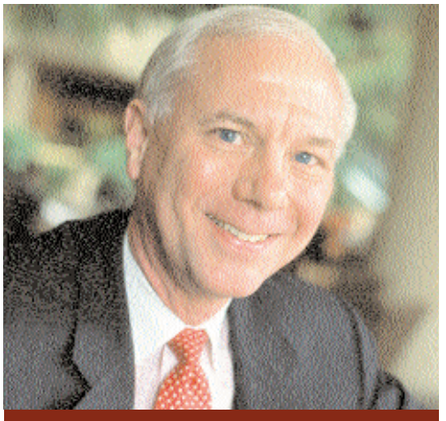
## Liquidity

Mr Aziz says liquidity risk is poorly covered in many institutional risk measurement systems. I agree. Where we differ is whether multi-step Monte Carlo simulation offers material improvement in this situation. It is true that for some securities the potential change in value to liquidation is greater than the potential daily change in unrealised gain or loss.

One way to capture this phenomenon is to assign a "liquidation volatility" to such positions, and use these to derive a "liquidation VAR". This results in a risk estimate embodying different time horizons for different positions. It is probably best tracked as a multiple of the standard daily VAR estimate. If this multiple increases significantly, it is an indication of growing concentration in illiquid positions that require specific review by risk managers.

It is not obvious that multi-step Monte Carlo offers a significant improvement over this fairly simple approach. Both require imposing judgementally determined stress sensitivity estimates that are themselves subject to considerable uncertainty. Modelling the unwind process day-by-day adds a level of detail that is hard to justify due to uncertainty in the basic assumptions.

I illustrated one of the weaknesses of VAR by considering a large written put and an equal-size written call with the same strike and expiry dates a couple of days apart. If the strikes are roughly at-the-money, the options will effectively hedge each other in a standard VAR calculation and show very little risk. As expiry approaches,



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however, their market sensitivities will start to diverge and, if they are exceptionally large, it may be impossible to execute an effective hedge. The trick is to have this situation highlighted well before the risk becomes unmanageable.

Mr Aziz writes that I "correctly assert that 'hidden risks' such as [this] can only be adequately assessed by explicitly simulating the position through time". In fact, I assert just the opposite. To be assured of capturing this risk through simulation, one would need a very dense coverage of the event space. Also, endogenous re-hedging would have to be very careful about liquidity constraints to avoid further masking the potential risk.

The sure way to highlight such excessive concentrations of strikes and expiry dates is the direct approach – explicitly examine the characteristics of the actual deals in the portfolio and report on concentrations that exceed specific guidelines. This assumes, of course, the presence of risk managers with the background to see the dangers in such concentrations, and the authority to mandate corrective action in a timely fashion.

Mr Aziz writes that: "Logically a framework that can incorporate all aspects of future uncertainty must dominate those that do not." I disagree. The choice of the best framework for modelling risk cannot be decided *a priori* on purely logical grounds. This choice must be significantly influenced by practical and empirical realities. In particular, the uncertainties incorporated in a given framework need sufficient empirical data and must display sufficient stochastic stability to be modelled effectively. Some uncertainties can be "incorporated" into a framework, but cannot be modelled objectively and reliably.

An overly ambitious approach is particularly problematic when it attempts to incorporate uncertainties related to behavioural reactions to future events. Such an endeavour is very risky even when substantial time-series data exist to support the estimation of behavioural relationships.

Structural change is a problem that must be addressed on a recurring basis. As a consequence, no serious econometric forecaster would contend that such a model can be used mechanically. The resulting projections are the product of a shifting mix of model structure and judgemental overrides.

## Empirical evidence

Compared with macroeconometric relationships, there is a paucity of empirical evidence on which to base a structural model of traders' behaviour. Moreover, structural change, in the form of personnel turnover and shifting management priorities, is also an obvious problem. Yet in a market risk context, such a behavioural model is essential to drive the re-hedging process if a multi-step Monte Carlo simulation is to be at all meaningful.

The risk assessments from such a process are qualitatively different from standard VAR estimates. They are far less grounded in objective data on historical behaviour, and far more dependent on subjective judgments about traders' risk tolerances and their resulting behaviour as manifested in the simulated re-hedging process. Moreover, despite this dependence, there is little basis for outsiders to judge the reasonableness of these subjective judgements.

I detect a fundamental difference of opinion here on the proper role of VAR. Mr Aziz would expand the concept to incorporate risk associated with funding, margining, collateral, settlement, bid-ask spreads, transaction costs, long-short constraints and behavioural reactions of traders to simulated future events. It is a grand vision of a fully integrated unified field theory of risk in all its myriad dimensions.

Unfortunately, I believe that embracing such a vision is to allow our reach to exceed our grasp. Doing so is to succumb to what Jacques Barzun calls scientism, "the fallacy of believing that the method of science must be used on all forms of experience and, given time, will settle every issue". Such an approach subsumes far too many phenomena into a highly technical black box, taking them beyond the critical evaluation and seasoned judgement of trading and risk management staff.

I agree with Mr Aziz that the industry is, and should be, moving beyond mere risk measurement to active risk management. I believe, however, that success in this effort will require using an eclectic variety of appropriate and actionable measures specific to individual business segments, not an integrated all-encompassing model that tries to capture risk in every possible form. ■