

Validating EPE

Empirical validation of trading credit exposure simulation models is clearly essential. David Rowe points out, however, that the process must differ significantly from traditional back-tests of VAR models

Sometimes terminology constrains our thought processes in unfortunate ways. I fear that back-testing is a current example of this. Within the Basel II context, back-testing seems to have become synonymous with empirical validation. Unfortunately, back-testing carries some very unhelpful baggage in the context of verifying trading credit exposure simulation models. Having been introduced in the context of verifying the performance of value-at-risk models, back-testing is widely viewed as a process that compares *ex ante* risk estimates with *ex post* results. Of course, even for daily market VAR models one must consider the impact of portfolio composition changes during the period in question. This is usually addressed by comparing the risk estimates with both the no-change profit and loss assuming a static portfolio and the actual profit and loss with or without inclusion of bid-offer spreads.

Unfortunately, when it comes to validating trading credit exposure simulation models that produce expected positive exposure (EPE) estimates, the whole concept of comparing *ex ante* risk with *ex post* realisations breaks down completely. The first issue to arise is the question of which future realisations are relevant. Exposure profiles are projected forwards for many years, not just for one day. Are all horizons to be included in the comparison? If so, are they all to carry equal weight in the validation process?

Even more problematic is the fact that the *ex ante* exposure simulations are explicitly based on an assumption of no change in the bilateral counterparty portfolio over its remaining life. This is perfectly appropriate, since the objective is to estimate the implications of existing legally binding obligations. In contrast, actual credit exposure realisations reflect continued trading and significant turnover in most major counterparty portfolios, especially for

more distant future realisations.

A useful first step is to abandon the loaded term 'back-testing' in favour of 'empirical validation' to describe the task at hand. Then we need to define what it is that requires verification. I contend that, broadly, three things need to be considered:

- the volatility term structure and mean reversion behaviour of each market driver;
- the approximate shape of the long-term distribution of each market driver; and
- the trend co-variation between all pairs of market drivers.

While this scope still leaves a complex challenge, it does provide useful boundaries for what is required.

I believe a sensible approach is to apply the technique of out-of-sample simulation common in econometrics. The idea is to begin by defining an approach for estimating parameters. For example, define volatility based on a certain length of historical data of a given frequency. Then derive resulting estimates for periods of that length ending on different dates occurring at regular intervals, say quarterly, over the past 10 years (or longer if possible). Finally, project the constant probability envelope of the variable from the end of each estimation period up to the present based on the parameters derived from the various historical samples.

This will give many observations of short-term risk estimates versus realisations with progressively fewer results for longer-term projections. It is also useful to simulate hypothetical trades whose value is driven by the variable in question and to compare the *actual* historical exposure to the *potential* exposure at various horizons. This could also include a variation on stress testing by paying special attention to historical periods when underlying rates or prices experienced unusually large changes.

Co-variation

Obviously, co-variation presents a more daunting problem, since the number of potentially relevant combinations is overwhelming. Some prudent selection of the combinations to be tested will be required. From a Basel II model review standpoint this would undoubtedly require consultation with supervisors. Some qualitative ground rules for defining required trade combinations based on the structure of a market-maker's specific portfolio would be very useful. Having defined the relevant combinations of variables to be tested, however, the exposure of standard combinations of trades with sensitivity to each can be analysed in the same fashion as the single trade simulations proposed in the previous paragraph.

Creating a system to value hypothetical trades based on actual historical data is the key challenge. Once such an environment is established, however, repeating the analysis need not be excessively onerous. Such a procedure would certainly provide more meaningful empirical validation for EPE models than a mechanical application of back-testing in the manner used for VAR models. ■

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