Second-order uncertainty

The financial crisis has drummed home the dangers of basing analysis on unreliable data. Despite its amorphous character, risk managers must begin to increase their focus on second-order uncertainty, argues ***David Rowe***

Those not trained in statistics often find the expression 'stable random process' quite puzzling. "How", they ask, "can a process be both stable and random?" The answer, of course, is that any one draw is random and, hence, unknowable in advance. If the random process is stable, however, then sizeable samples will exhibit broadly similar characteristics, such as the mean, the dispersion (standard deviation), the degree of symmetry or lack thereof (skewness), and the tendency for probability in the tails to dwindle rapidly or slowly (kurtosis). The larger the sample size, the more such characteristics will be nearly identical across randomly selected sets.

Classical statistical analysis recognises that sampling techniques can never produce fully exact values for these parameters. This leads to a derivation of what are know as 'errors of estimate'. These are based on a range of values and associated probabilities for what the 'true' value of a characteristic may be in light of the sample estimate and the size of the sample under review. The most common form of this is the 'standard error of estimate', which is simply the standard deviation of the implied distribution of possible values for the true underlying parameter.

What is vital for general business executives to recognise, however, is that *these errors of estimate assume stability of the underlying stochastic process*. This is often a realistic assumption when dealing with physical processes. It is virtually never the case in a social scientific setting. Structural change is the constant bane of econometric forecasters. Such changes are driven by a wide variety of influences including technological advances, demographic shifts, political upheavals,[1] natural disasters and, perhaps most importantly, behavioural feedback loops.

Structural change creates a fundamental dilemma for socio-statistical analysis. Classical statistics argues the more data the better since, assuming stochastic stability, this results in smaller estimation errors. For analysis based on time series, however, more data implies incorporation of a greater range of structural changes that undermine the classical assumption of stochastic stability.

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This makes it all the more important for risk managers to focus obsessively on what I call 'statistical entropy'. Like water, information can never rise higher than its source. In the case of information, that source is the data on which an analysis is based. In assessing the reliability of any risk estimate, including such things as credit ratings, always start with a review of the extent and quality of the available data. No amount of complex mathematical/statistical analysis can possibly squeeze more information from a data set than it contains initially.[2]

The most recent glaring example of a failure to focus on second-order uncertainty was the way many banks blindly accepted the AAA-rating for senior tranches of subprime mortgage portfolios. Such holdings were often treated as equivalent to AAA corporate bonds. Of course, rating agencies have about a century of experience in rating bonds. This provides a wealth of experience and data to support the effort. Subprime mortgages are a fairly recent phenomenon and their default experience has been dominated by a period of fairly benign housing markets with stable to rising prices. Determining how much subordination was necessary to bring the chance of any failure of timely payment of principal or interest down to a target level required making an estimate of behaviour deep into the tail of the default distribution.

A casual look at the available data for conducting this analysis would have made one thing clear: any estimate of the required level of subordination would necessarily be surrounded by significant uncertainty. We know this market was undermined by serious erosion in underwriting standards to meet the apparently insatiable appetite for these securities in 2005 and 2006. Even before consideration of this type of corrosive feedback loop, however, the limited data supporting the original AAA rating alone should have made banks wary of building up uncontrolled volumes of such securities.

The fundamental lesson to take from this experience is always to ask how much second-order uncertainty surrounds risk estimates. When such uncertainty is clearly excessive, be especially cautious in taking on corresponding exposures. ■

[1] Some time in the early 1980s, I came across an old working paper entitled 'An Econometric Model of Iran'. Unfortunately, it was written in 1978! This is one of the most dramatic instances of being blindsided by structural change I can recall

[2] Indeed, in complex settings it is virtually impossible to extract 100% of the information that does exist. Something is always lost in the process of aggregating and summarising. This is why I refer to the 'law of statistical entropy' rather than the 'law of the conservation of information', drawing an analogy to the second rather than the first law of thermodynamics

Rowe.indd 91 12/3/09 14:36:38