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I think of financial engineering as being the intersection of three disciplines: financial theory, quantitative methods and computer science. I believe there has been, and will continue to be, a rotation of influence on financial engineering from each one of these fields.

The various effects from developments in the three disciplines are illustrated by the history of financial engineering. In the 1970s, financial theory was radically changed by Black-Scholes-Merton option pricing theory. But this was simply theory, and financial engineering demands practical application. At the time, this meant option traders required implementations of the formulas, hedging strategies and other portfolio management techniques, and for the most part, such implementations appeared first on the traders' hand-held calculators, and later on their relatively crude DOS operating system computers.

Computer science was a smaller player, and developers were very constrained by available technology then. Quantitative methods appeared briefly at this point by asking how the cumulative normal distributions should be calculated – via a standard five-digit approximation, a seven-digit approximation, or some other means? (The seven-digit method won, because of accuracy needs for out-of-the-money options, after recognising the differencing of such functions involved in the formulas also gave rise to round-off problems.) An early discovery one makes in financial engineering is that a formula and an algorithm are very different beasts, with the former influencing perhaps only half the construction of the latter.

For those of us in commercial financial engineering, the 1980s saw another huge change when people moved from dedicated calculator and computer applications to spreadsheets for most of their computational activities. Lotus 1-2-3 provided 'add-in functions' that made it possible to implement, say, option-pricing code that could share equal status with the Lotus 1-2-3 intrinsic functions. This represented a major change in how financial engineering was delivered. It was driven almost exclusively by computer technology changes, changes that persisted into the early 1990s, when MS Excel replaced Lotus as the spreadsheet of choice. (My company, Financial Engineering Associates (FEA), still has a number of trademarks beginning with the '@' sign, which Lotus used as an escape character for 1-2-3 add-in functions.)

In the mid-1990s, JP Morgan's RiskMetrics Technical Document had a major impact on the practice of risk management. I consider this a watershed in both financial theory and quantitative methods. In financial theory, it introduced a new 'cashflow' space that brought derivatives, multiple asset classes and temporal mismatches under one roof, materially and substantially improving its modern portfolio theory predecessor. (Yes, this may constitute a heretical position, but I believe it actually replaces modern portfolio theory with a superior framework by introducing explicitly the cashflow space.) The document also made contributions to quantitative methods, suggesting specific interpolation and extrapolation methods, practical data treatment methods and a number of other mechanisms for dealing with the practical computation of market risk metrics.

Financial engineering for energy in the late 1990s provides another interesting story about the relative influence of the three disciplines. First, it became obvious from studying energy data that the standard option pricing process models were inadequate in the face of evident seasonality, mean reversion and frequent price spikes. FEA was very involved in the theory development side for appropriate energy price processes, but this was beset by numerous open questions, principal among which was whether energy traders could come to accept the new parameters and calibration processes. Traders were used to trading 'vols' in standard option markets, but could they also trade 'reverts' (for reversion speed) or 'jumps' for price spikes? And where were the 'normal' levels of price reversion in the face of seasonalities? Or would traders wish to set their own normal levels and, if so, could these be made consistent with no-arbitrage principles? In effect, our financial engineering efforts were almost at the point of involving a fourth discipline – the psychology of trading.

It is difficult to forecast new and dramatic innovations in financial theory, which might necessarily involve surprise. But it is pretty easy to forecast an enormous impact arising from the directions in which computer technology is heading. I believe web services are offering us a movement towards a common set of standards for the interoperation of component software that will have a major impact on financial engineering in the future. I view the main benefits of web services not as being the ability for web users to combine elements from various websites (although that is certainly a possibility); but rather, the 'big win' of the web services movement will be the ability of corporations to minimise their integration costs, both within and between companies. For financial engineering, I believe this portends something I have referred to in numerous talks as 'enterprise analytics', namely the capability of providing enterprise-level scope to the algorithms that implement financial engineering solutions. While I cannot yet share a specific vision of what enterprise analytics is, I think I have begun to understand the benefits at which it is aimed. To provide a brief look at some of these benefits, consider, say, a basic option-pricing algorithm approved for use throughout a company. How can we make this one algorithm highly available and uniform across all the front-office, back-office, middle-office and other applications of the enterprise? Such availability and uniformity are key benefits of enterprise analytics, which, when it arrives, will have a much more sweeping impact than the introduction of spreadsheets ever had. Hence I feel pretty confident in saying that computer technology will be a major driver of financial engineering change in the next five years. ■