The Legal Intelligencer

Litigation Support

Rolling the Dice With Monte Carlo Simulations

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Just the phrase "Monte Carlo" invites images of glamorous women and debonair men gathered around a baccarat table—ah, the glories of James Bond. While most of us will never see the inside of Casino de Monte-Carlo, it's a safe bet that we will run across a Monte Carlo simulation.

A Monte Carlo simulation is a statistical analysis tool that works well in situations with multiple variables that fall in a known range with equal (or predictable or subject to portion estimation) probability. For example, Ajax Corp. litigates over lost profits on its ever-popular widgets. The widgets require three primary components: Input-A, which costs $2 per unit, but can be purchased at a 10 percent discount in volumes over 1 million units; Input-B, which has a base cost of $5 per unit, but can fluctuate based on the price of oil; and Input-C, which costs $3 per liter with volume discounts, but has special storage requirements increasing warehousing costs for larger orders. Taking advantage of volume discounts would reduce the unit costs of the inputs, but increase warehousing costs and tie-up working capital, a limited resource. Ajax's business plan indicated initial widget sales between 50,000 and 150,000 units per month with growth of 7 to 10 percent per month for the first two years leveling out to 3 to 5 percent, annually, thereafter. As even this relatively simple example illustrates, commercial transactions involve many interrelated variables.

One option is to assume certain values for these variables and present the fact-finder with a simple, point-specific result. For all of its simplicity, the cross-examination questions are self-evident: "You assumed initial monthly sales of X units, but if initial monthly sales were only Y units, your calculations would be wrong, wouldn't they?"

A Monte Carlo simulation, on the other hand, addresses a wide variety of variable inputs by computing results thousands of times with random values for each of the variables within the defined range. The U.S. Court of Appeals for the Fifth Circuit explicitly approved the use of Monte Carlo simulations in *Lyondell Chemical v. Occidental Chemical*, 608 F.3d 284 (2010). The case involved claims for contribution to a hazardous waste remediation project. During the 1960s and 70s, a trucking company hauled hazardous waste for several petrochemical facilities. The trucking company dumped the waste primarily at one facility, but occasionally resorting to a backup site. Two of the trucking company's customers settled with the U.S. Environmental Protection Agency, and sought contribution from other customers for the cleanup costs. The trial court appointed an environmental engineering expert to allocate the cleanup costs at the backup site among the various parties. Using court-determined data points, the expert computed each party's share of the costs. The defendant challenged the reliability and relevance of the expert's conclusions.

While ultimately reversing because information volunteered in settlement discussions formed the basis of the data inputs of the analysis, the Fifth Circuit found that "Monte Carlo simulation is not inherently untestable: courts routinely admit statistical evidence, and we can gauge reliability by examining input values and requiring transparency from testifying experts." According to the court, verifying the data and the formula through which it is analyzed is sufficient to establish reliability. As other courts reviewing expert analysis based on a Monte Carlo simulation have ruled, "If you make bad assumptions, you obtain bad output" (*In re Application of Erie Boulevard Hydropower L.P. v. Town of Ephratah Board of Assessors*, No. 17–1–2000–0331, (N.Y.Sup.Ct. Apr. 11, 2003)), or, in the vernacular, "garbage in; garbage out."

As the Fifth Circuit noted in *Lyondell*, courts have no problem with Monte Carlo simulations as a method. Rather, the problems seem to arise from the data. In *Lyondell*, the fault lay with the trial court that hired the expert and directed him to use certain data values that the court had culled from information that should not have been admitted in the record. More recently, the Eastern District of Pennsylvania granted a motion to strike expert reports and testimony based on a Monte Carlo analysis in a case alleging breach of duties of good faith and fair dealing. But, as the *Lyondell* court suggested, U.S. District Judge John R. Padova of the Eastern District of Pennsylvania's concern was the validity of the assumptions contained in the analysis, not the methodology itself.

In *MyServiceForce v. American Home Shield*, Civil Action No. 10-6793 (E.D.Pa. May 2, 2014), the defendant, American Home Shield, a provider of home warranties, used a network of contractors to provide the repairs under those warranties. The defendant contacted the plaintiff, myServiceForce, to develop software that it could use to improve monitoring the assignments among those contractors. Ultimately, they agreed that AHS would pay a portion of the development cost and the plaintiff would sell a "client" version of the software to contractors that they could use to provide the defendant with status reports on open work orders. While AHS had agreed to help promote this software among its contractor network by requiring status reporting that the software automated, it didn't actually enforce contractor compliance with those requirements.

The plaintiff proffered an expert to opine on the lost revenues and profits from the defendant's failure to enforce the reporting requirements among into contractor network. The expert based his lost-profits analysis on a Monte Carlo simulation that varied the "ramp-up" periods for how quickly the defendant's contractor network would adopt the new software. Underlying all of his scenarios was an assumption that all 4,500 contractors would adopt either the new software or the defendant's original, less automated reporting system.

Padova faulted the analyst not for his use of a Monte Carlo simulation using best-case, worst-case and most-likely-case scenarios, but for his assumption that all of the contractors would, in fact, comply with the requirement. Around six months after the rollout of the new software, AHS had selected a "target group" of 191 contractors to "pressure" into complying with the reporting requirements. The pressure on that target group included telephone calls regarding compliance and reductions in work assignments. Those enforcement efforts resulted in eight contractors subscribing to the plaintiff's software and between seven and 21 contractors complying through other means.

The expert based his Monte Carlo simulation on an assumed market penetration between 28 percent (eight of 29 contractors responding to defendant's influence) and 53 percent (eight of 15 contractors responding to defendant's influence). The expert completely failed to consider that 162 contractors, or 85 percent of the target group, completely ignored the defendant's efforts to enforce compliance. As Padova found, the defendant's obligation of good faith and fair dealing did not require it to ensure compliance with the reporting requirements. While there was evidence that it had failed to make any effort to encourage its contractors to provide timely status reports, the expert's assumption that the defendant's satisfaction of its contractual obligation would have resulted in 100 percent compliance failed to fit the evidentiary record.

Cases involving Monte Carlo simulations confirm that this is an accepted statistical technique for dealing with complicated situations involving multiple, inter-related variables. The key to admissibility of a Monte Carlo analysis is making sure that the underlying assumptions clearly fit the evidentiary record. The expert is well served to verify the sources of data provided and the ability to support the details of the calculation and the underlying theories applied.

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