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# Are Financial Models Really to Blame?

By John R. Segerstrom

*Betting more than you can afford to lose because someone else is doing it won't help in the face of event risk.*

One popular theme flowing through discussions of the cause of the financial meltdown is an indictment of the sophisticated computer-based risk analysis models used by investors to get us here. I offer the premise that this blame is not only misapplied but may, in fact, be counterproductive. My premise is rather that there have been three misunderstandings of the basic model prototype. In addition, human weaknesses in models' employment by management contributed significantly to problems today.

## Assumption of Science

The modeling concept is almost as old as the computer itself. There is debate about the first significant application, but regardless, model building began as the creation of a mathematical "picture" of a process the modeler wanted to study without having to watch the process itself. The orientation was (and remains) scientific, and the natural process was well understood before building the model, so the model was usefully accurate, and its accuracy could be tested and confirmed. The migration of the computer into the financial industry began in the accounting arena, where accuracy was again assumed, and was demonstrable. Plus, the accounting paradigm was—and is—widely understood.

With deregulation, however, accounting reports were inadequate for future risk analysis. The budget cycle was adapted to an analysis of projections incorporating different assumptions. Then, simplification began to emerge to make it possible to analyze more future scenarios conveniently. The simplest might have been the "gap" model of interest-rate risk in which periodic yield-sensitive assets less the yield-sensitive liabilities (the gap) is multiplied by a rate change to estimate the dollar value of the margin risk of changing interest rates. In pursuit of better

reliability, these simple models were enhanced with assumed relationship trends, and probabilities, and management was presented with a summary of the model's determination of the institution's risk profile in the area being evaluated.

When the results were deficient either from a return or a risk standpoint, the modeler was encouraged to find a hypothetical product, service or both that, if adopted, would make things better. At this point, uncertainty overtook knowledge: In addition to price and volume risk, the result now took on the entire panoply of risks including liquidity, funding, regulatory, credit, competitive and other risks. But these additional risks weren't "embedded," so to speak, or were assumed to be constant in the price/volume model. The presentation remained scientific, using words like "normal, statistical, exponential, linear, mathematical, second-order" to explain the workings of the computer program producing the results. Assumptions made by the modeler were rarely discussed. Management was impressed: How could a computer calculation based on such sophisticated mathematics be wrong? Well, it could be wrong if those assumptions don't pan out. We know now, too, that the most acute analysis of an individual risk can lead to a punishing result if the links between that risk and the other risks facing management are ignored, as they usually have been.

The evolution of financial modeling reached its current state because some creative computer analyst noticed that by combining the risk-return profiles of two products, he or she could improve the overall risk-return relationship projected by the model. Two sets (or more) of undisclosed assumptions were combined, and the risk-return profile, calculated to high accuracy, was presented to management as

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science. From this first step, modern portfolio theory and the derivative contract evolved. The review and testing of embedded assumptions, and of potential future departures from historical relationships that are the essence of those underlying models, failed to keep pace.

### Assumption of the Model's Question

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A financial model is a computer program, the two purposes of which are (1) to quickly manipulate data and (2) to check completeness (that is, consideration of all relevant factors). Both are undertaken in response to questions posed by management, such as, "Should I buy another \$500 million term notes for income, in spite of the market risk? Is it still profitable if I hedge that risk?" There are plenty of models available commercially to address these questions, and if you ask any bond dealer you can have your questions answered for free.

But unless management asks, the model's result will include assumed answers to questions like "Where should the money come from? What will happen to our short-term interest rate risk? Will the funding change our liquidity needs? Our equity requirements?" The assumed answers to these linked changes to the institution's risk profile could easily mask potential disaster.

As a real example, a \$2 billion asset bank with a strong equity position was approached to invest in a derivative asset, four-year maturity, rated AA, and insured with a credit-default swap. The proposal included the funding for the transaction, backed up with a third-party financing line, and the transaction promised a four-percent net spread to the bank—and a 40-percent increase in post-tax return on equity (ROE)! It seemed almost too easy.

If the salesman had instead promised a huge return from lending the bank the money to buy a participation in a loan, secured by a house mortgage, on leased land, out of the bank's area, to someone it won't ever meet and about whom little is known beyond his name, whose brother vouches for his credit, and who's paying three percent of the loan

in sales commission, then the bank's decision would have been just as easy—but probably not the same as the one it made. The outcome has been bad, and the bank's senior credit officer now sits on its investment committee to ask, in the future, those questions that were missed by the bank this time.

It's a true story, one many readers will recognize, and in retrospect its conclusions and likely outcome are obvious. But it does serve to emphasize that, from a "silo" investment perspective, a financial model would give a strong endorsement to the proposal—unless the model's analysis recognized that the AA rating made questions of liquidity and credit risks key parts of the decision process. More comprehensive features like this, called "linked risk" analysis, is a major model design effort now. Understanding and implementing such tools are being pursued to protect against another failure in the practice of risk management.

### Assumption of Expertise

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The inductive basis is the large variety of capital market behaviors that have been empirically observed to fit well with the non-linear paradigm.<sup>1</sup>

Too often these models are created by quantitative experts working at some distance from ... the senior executives who will use the results.<sup>2</sup>

That first quotation is an effort by an experienced financial model expert to convince his audience that the failure of today's risk analysis models is that they are linear and that by making them nonlinear we will be protected next time. The second quotation indirectly addresses the fact that most decision makers have no idea what the first quotation says, to say nothing of being able to evaluate its veracity.

Still, senior executives, relying on what the first quotation refers to as linear models of risk, wrote so-called credit default swaps (CDS) by the trillions of dollars in the past few years. A CDS is an insurance policy: An insurer promises a payee that its payer will pay what it owes the payee, and the insurer charges someone<sup>3</sup> a "premium" based on

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*Financial models did not let us down.*

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the risk it sees of having to pay. The model used was based on a detailed historical analysis of prior default rates by payer-type borrowers. The insurer sets its premium at its calculated risk plus a profit, and it has only to insure enough payers to justify the model's diversification assumption. For a little more premium, the insurer was willing to agree to deposit cash "collateral" (taken from its reserves) with a payee if its payer's stock price drops or if the insurer's bond rating drops. There were other options including allowing purchase of CDS by non-payees (pure speculation). All this was thought to be plugged into the insurers' models. The risk-return relationship was maintained at an actuarially sound level. Like life insurance, sort of.

Most experts believe that a portfolio of simple CDS contracts held by a solid insurance company would have survived the recession on an equity basis, as the actuaries and statisticians had predicted. What the actuaries failed to account for—the risk of a broad market decline and the risk of a bond rating hit to the insurer from rating companies and the magnifying effect of writing insurance for speculating quasi payees—amounted to the sale by the insurer, for an apparent profit, of that diversification that their model's analysis had assumed. Risk ballooned unnoticed, and it was these three lost bets that created the equivalent of a "run" on the insurers' reserves, as would happen if suddenly an epidemic struck a life insurance company's insured population. They ran out of cash, not equity; they owed a huge amount and had to turn to the taxpayer to meet their obligations.

There are plenty of stories like this, in banking, brokerage, lending in particular, all confirming the message of the two quotations at the beginning of this section.

## Then, and Now and Tomorrow

By this point I hope the case is made that financial models did not let us down; rather, we let them down by expecting (or assuming) more of them than they could deliver. In fact, the experts can never refine the techniques of automated financial analysis to the point that they can be delegated management responsibility, as their current indictment implies.

Overreliance on financial tools does not excuse the errors of oversight and erroneous decisions that have given bad results. In fact, judicious application of these tools is essential for today's—and tomorrow's—financial environments to be understood and managed. We just need to learn from our mistakes.

Going forward, one clear mandate to management is to demand to know the data, assumptions, omissions, questions and risk relationships incorporated within a computerized analysis. This, in turn, requires overcoming the strong human tendency to defer to apparent experts, which exists even if the expertise presented isn't in the field addressed by the analysis. Never let the analysis become the decision. Rely on informed management judgment, incorporating any conclusions of the analysis.

A second mandate is never to allow a model to limit thinking. According to renowned scientist Freeman Dyson, "The climate-studies people who work with models always tend to overestimate their models. They come to believe models are real and forget they are only models." A *NEW YORK TIMES MAGAZINE* profile described Dyson as believing that "truths of science are so profoundly concealed that the only thing we can really be sure of is that much of what we expect to happen won't come to pass."<sup>4</sup> Thus, a financial model should never lead to the placing of an amount at risk the loss of which would challenge the viability of the wagering entity—regardless of the calculated probability of loss.

A third mandate is to remember that we all tend to see what we are looking for. A credible analysis that confirms our bias is hard to challenge; a result contrary to a decision we prefer is difficult to accept. Remember, a financial model is math, done over and over very quickly, without bias. Once the math is validated,<sup>5</sup> then it reaches the wrong conclusion only when it receives the wrong input (or when necessary input is not understood as being necessary).

Finally, a fourth mandate is to be conscious of the human herd instinct, leading us to copy those we respect, as well as our professional peers. There is risk in being different, and so the justification, "Everybody else was doing it," is heard about as often as "It was the model's fault." No other context is ever identical to yours. Betting more than you can afford to lose because someone else is doing it, or because your model's analysis indicates it's a good

deal, won't help in the face of so-called event risk—the risk that something fatal will happen that no one even considers possible when the decision is made. In words variously attributed to Mark Twain, Will Rogers and John Maynard Keynes, “I am more concerned with the return of my money than the return on my money.”

### Endnotes

<sup>1</sup> James G. Rickards, *A New Risk Management Model for Wall Street*, RMA J., Mar. 2009, at 22.

<sup>2</sup> Rocky Ieraci, *Enterprise Risk—RAROC*, RMA J., Mar. 2009, at 68.

<sup>3</sup> The premium might not accrue directly to the payee but at times to the payer, the selling broker or another third party interested in the issuance of the CDS in favor of the payee.

<sup>4</sup> Nicholas Dawidoff, *The Civil Heretic*, N.Y. TIMES MAGAZINE, Mar. 29, 2009, at 32 *et seq.*

<sup>5</sup> In the banking industry, regulation stipulates that analytical models be formally validated by a qualified third-party review producing a detailed, written report. The report must describe the validation's work and attest to the representations of the model and its designer(s). Questions that arise are to be fully aired in this validation report.

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