From *SIAM News*, Volume 42, Number 1, January/February 2009

Financial Mathematics '08

Mathematics and the Financial Crisis

By René Carmona and Ronnie Sircar

The ongoing financial crisis once again has provided the international press with plenty of cheap filler material for "debating" the role of mathematical models and mathematicians in the finance industry. Under pressure to provide simple answers to highly complex issues, the media has chosen to fuel public skepticism of quantitative matters by identifying culprits, the so-called "quants," to be burned at the stake. In a form of modern witch-hunt, fingers are often pointed at financial engineers and mathematicians. Warren Buffett, whose reputation as a savvy investor gave credibility to his crusade against derivatives, led the charge. "Beware of geeks . . . bearing formulas," he said in a recent interview with Charlie Rose. In addressing some of these issues in this article, we naturally risk appearing defensive, but in writing for *SIAM News* we know we are preaching to the converted when we say that there is nothing to fear from people who use formulas as a means of expression. In fact, these geeks should have been listened to instead of being ignored or quarantined. For quants were not in such positions of power in banks that they can fairly be held responsible for the excessive leveraging and risk-taking that occurred. We wish they had been in such positions, and hope that we will now see a cultural shift in the structure of these firms, with quants hired by and reporting to management, rather than to traders.

"The Economic Crisis and the Future of Financial Engineering": Four panelists—from left, Joseph Langsam, Alexander Lipton, Mark Davis, and Dilip Madan—discussed the current crisis, in particular the role of the mathematical models used in the finance industry. Problems have arisen, panelists indicated, in part because of the tendency to look at the system in pieces rather than as a whole. In the words of Davis, "It's not a realistic way of modeling things. When the house falls down, you can't say you're fine because you're in the half that didn't fall down. [The one that did] brings down the value of what's left."

Discussions of how the banks got themselves into the positions they did often center around the models, and the typical question is, "Were the models wrong?" or "Were the inputs to the models wrong?" Whatever answer one chooses to give, the larger failure is human, in how the risk models were developed, understood, managed, applied, and, for the most part, ignored. One of the most common misconceptions about the financial industry is that it has slavishly applied the results of academic research on risk management (we wish!). Sure, investment banks have been able to recruit some of the best and brightest PhDs in mathematics and physics. They have also managed to produce in-house some of the most innovative research in financial engineering while keeping up to date with the most recent developments in academic research in financial mathematics. All this gray matter and savoir faire, however, took a back seat, as priorities were dictated by opportunistic trades, irrespective of quant recommendations, and with the blessing of managers willing to look the other way when risk controls threatened profitable deals.

As we have learned in the past year, those responsible for the grossly irresponsible credit derivatives trading and the ensuing risk exposure were not people who had been quantitatively trained. Far too often, they rose to their positions on other criteria, with deal-chasing ability, sales, and other attention-deficit-promoting activities ranking high. Their typical gut reaction to a model invested with too much thought runs along the lines, "Why doesn't the curve go through all the points?" or "Why does it take so long to run?" Yet these were effectively the drivers of the research that led to the dominance of trader-pleasing models in recent years, the most notorious being copula-based models of correlated defaults. Quants could no more voice their contempt for copula models to traders (and keep their jobs) than Pentagon staffers could stand up to the Administration with doubts about weapons of mass destruction in Iraq. Should the quants have resigned in protest? Perhaps, but who would have noticed, and would anything have changed?

With this emotionally charged background, and despite a bleak economic outlook, the SIAM Activity Group on Financial Mathematics and Engineering held its second conference in New Brunswick, New Jersey, November 18–19, 2008. The two-day conference was co-organized by René Carmona (Princeton University) and Paul Feehan (Rutgers University). It featured a mix of invited speakers from the financial industry and academia: Peter Carr (Bloomberg LP), Mark Davis (Imperial College London), Helyette Geman (Birkbeck University of London and ESSEC Business School), Kay Giesecke (Stanford University), Alex Lipton (Merrill Lynch, London), Dilip Madan (University of Maryland), Olivier Pironneau (University of Paris VI), Ronnie Sircar (Princeton University), and Nizar Touzi (Ecole Polytechnique, Paris).

The conference was a success. There were more than 170 registered participants, including many PhD students and recent graduates, who make up a large proportion of the activity group. But the large contingent of practitioners underlines the high level of anxiety created by the cur-

rent financial crisis. A panel discussion, "The Economic Crisis and the Future of Financial Engineering," was added to the original program as a forum for the discussion of causes and consequences of the crisis, and the outlook for employment of graduates of the numerous master's and PhD programs in financial mathematics. The panel discussion was introduced and moderated by René Carmona. The panel members were Mark Davis, Joe Langsam (Morgan Stanley, New York), Alex Lipton, and Dilip Madan. The four panelists, having all held positions in academia and worked in the financial industry at some point in their careers, were perfectly positioned to present a broad view of the events leading to the credit crunch, the intricate web of complex credit securities at the heart of the default or near-default of major institutions, and the changes to be expected in an industry that will likely never be the same.

Financial mathematics is a growing part of applied mathematics: The SIAM activity group has seen steady growth since its creation six years ago, and its membership now exceeds 600. The conference coincided with the recent launch of the *SIAM Journal on Financial Mathematics*, which was approved by the SIAM Council and Board last July in San Diego during the annual meeting, making SIAM the first society to devote a journal entirely to financial mathematics.

SIAM and the applied mathematics community in general have a huge role to play in stepping up to the scientific vacuum resulting from the crisis. Forward-looking financial institutions have already started to forge closer collaborations with universities, in antithesis to their previously paranoid proprietary secrecy. QPL (Quantitative Products Laboratory), a collaboration of Deutsche Bank with Humboldt Universität and Technische Universität in Berlin, and the Man Institute at Oxford University are cases in point. Banks are restructuring their modeling teams to make them independent of traders and have them report directly to management. The problem on Wall Street and in the ratings agencies has not been the excessive influence of science and mathematics. The problem has been too little mathematics.

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