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Speed of Markets Accelerates Model Degradation

January 21, 2008 *By Maureen Nevin Duffy*

Financial models are based on assumptions made by the best and the brightest on Wall Street--the quantitative financial engineers, or quants. But when events occur that shake up those assumptions, the models degrade. The bank that most quickly recovers its models, or replaces them with new ones, wins.

Not so long ago it was rare for PhDs to be trading. "Nowadays many more quants get involved in not only building these models, but running them and being principals in the business," says Emanuel Derman, professor and head of the financial engineering program at Columbia University and author of "My Life as A Quant: Reflections on Physics and Finance."

Derman wrote in *Risk* magazine ten years ago that he hoped to "see progress in building models that are both market-calibrated and evolutionarily realistic." His wish has come true: The impetus has shifted from derivatives to predictive models, "or models that try to decide which electronically traded stocks and futures are cheap or rich," he says. More of today's quants, according to Derman, tend to work in factor models and prediction.

But those models did not hold up under a period of unusual market volatility in August, generally believed to have been triggered by a widespread move to cash. That four-day event--from Aug. 7 to Aug. 10--caused "many people to jump," notes Brad Bailey, senior research analyst with Boston-based Aite Group. In its aftermath, quants scrambled to figure out where their models had failed.

"Quantitative models, regardless of the asset classes, just blew up," explains Bailey. "It was the kind of paradigm shift--not all that unusual--that occurs when everyone wants to get out of a certain trade or position at the same time. No matter how good the model, when panic takes over, you can throw the mathematics out the window."

At the time, Bailey says, there were "tremendously unusual moves" in foreign exchange trading, with a lot of hedge funds trying to unwind positions they'd financed with low interest rates in Japan. "There was a lot of forced selling, margin calls and then an incredible bounce back." The turmoil "hurt a lot of trend-following systems."

Limited Life Span

Such catastrophic shocks to the system, though relatively rare, are considered inevitable. But there are less obvious influences that can reduce a model's shelf life--human behavior, for one.

"Over time everyone piles into the same strategy, sometimes triggered by quants leaving one firm and going to another," says Derman. "Then people try to trade at a higher frequency to get ahead of the other people, and eventually the arbitrage disappears." He adds, "The other thing that destroys these models is changes in market participants' behavior, especially rapid changes."

"The models are statistical in nature," says Derman, "and often the P&L vanishes for a while, and then the quants running it have to figure out whether that's a temporary statistical fluctuation or whether it's the end of the model's efficacy."

That question also falls upon vendors that develop risk management tools for buy-side portfolio managers. "We are always adapting to an ever-changing risk landscape," says Jennifer Bender, a VP of applied research at New York-based MSCI Barra, where she does portfolio management and risk-related research for asset owners and investment managers. MSCI Barra's risk models and portfolio analytics are used by over 900 clients, including the ten largest asset managers in the world.

Bender, a former quantitative analyst at State Street Associates, recalls three major short-term shocks, all in 2007, that upset models--in February, August and November. "The Feb. 27 shock, which in some circles has come to be known as the Chinese correction,' was short-lived and reversed over the subsequent week. The August shock ran longer."

"There was a huge drop in certain types of stocks" in August, she says, "specifically high book-to-price stocks that had been performing very well in recent years."

"In November, we witnessed dramatic corrections in certain segments--mainly in financials--on the heels of write-down announcements by some of the major Wall Street banks," says Bender. These are the silver bullets that penetrate even the best models.

An Art and a Science

"A good model can't just be backward-looking," she contends. "Our clients need an accurate assessment of past and predicted future volatility to help them maximize their risk-adjusted return. Good risk models require constant innovation and a blend of art and science." The art is in combining market insight with established quantitative techniques.

Quants say that the best risk modelers recognize the weaknesses in the assumptions they've chosen to include and know exactly where to look if an event triggers that weakness.

MSCI Barra boasts one of the largest research departments in the risk and analytics business. Researchers work in a cooperative environment with their clients, says Bender, rather than "in a silo." They exchange observations and information in their quest to refine models in light of market changes. The more sophisticated the client's strategies--for instance those that include complex derivatives and structured products such as collateralized debt obligations and asset- and mortgage-backed securities--the more sophisticated MSCI Barra's risk models have to be to keep ahead.

"We have to measure risk on products that didn't exist five years ago," says Bender. Aside from the major events that can and do happen, the speed of product innovations has increased the need to upgrade models regularly. "We have models that are updated on a daily basis," she notes. While the models are built with the help of computers, modelers have to be sensitive to developments in the market environment, and technologically savvy about new information feeds, tools and instruments for responding to a rapidly evolving marketplace.

Then again, as Derman wrote in 1997, "In most cases, the world doesn't really behave in exactly the way you have constructed it."