Risk Management
New tools for a post-financial crisis era

Investors seek to test varied risk exposures

By **BARRY B. BURR**

Institutional investors are reaching out for new risk management tools to address shortcomings in estimating risks that left them more exposed to losses in the financial market crisis than they expected.

To improve systemic risk management, some investors have embraced new tools, although each has its limitations: Among them are:

- network analysis, including counterparty analysis;
- agent-behavior analysis;
- extreme value theory;
- expected shortfall risk;
- multihorizon analysis;
- leverage risk and
- funded status monitoring and attribution.

The financial crisis of 2008 exposed limitations on risk management tools and the way they predict risk. As a result, pension funds and other assets owners need to understand three key things, said Sebastian Ceria, CEO of Axioma Inc., New York. "Understand performance and risk on assets, understand liabilities and exposures on assets, and understand exposure an institution takes on with its counterparties, particularly through derivative transactions."

In general, Gordon Fletcher, partner at Mercer, New York, said, when you measure risk, you just don't look at asset risk through models such as value at risk. "You have to look at whole funded status risk, how assets and liabilities move together," he said.

Along that line, Mr. Ceria said, macroeconomic models are being developed "that allow (asset owners) to tie the assets that they hold to macroeconomic scenarios that may affect the risk of their portfolios. … For that you have to be able to map your portfolios to (different) macroeconomic scenarios" so "that when you stress your portfolio … you see how (it) will react."

"One of the key things asset owners now realize in the context of risk (is) they cannot look at risk in a short-term horizon exclusively," Mr. Ceria said. "They really need to map the horizons of risk with the horizons … more related to the (multiple) investment horizons they have" and consider how risk interacts with them.

"You cannot just look at (assets and liabilities) as one horizon where everything matters and in the other horizons things don't matter," Mr. Ceria added. "We are not living a one-period game. We are living a multiperiod game."

Exposed limitations

The financial crisis exposed limitations in risk management tools and the way they predict risk, including value at risk, a popular measure for evaluating overall portfolio risk.

Shelley Kusnetz

FALSE FEELING: According to Bruce I. Jacobs, value at risk could give asset owners a false sense of safety and lead them to take on more risk than they realize.

"There is a move away from just focusing on a single number like value at risk … this idea that by just looking at one number you can know what the risk is in your portfolio," Mr. Ceria said. "One number is too little. I don't care how sophisticated that number is … one number is not enough."

VaR could lead asset owners to take on more risk than they realized. VaR is backward looking, assumes markets will behave as they have in the past and favors assets with low risk and low correlations, leading investors to believe they "are in a safer position," said Bruce I. Jacobs, principal, Jacobs Levy Equity Management Inc., Florham Park, N.J.

That confidence encourages investors to use more leverage than they might otherwise, taking on more risk while attracting others to invest in these assets, leading to potential illiquidity.

But when "safe assets" turn into high-risk assets — such as in the mortgage-backed securities collapse — it can bring on a systemic crisis, an extreme event, Mr. Jacobs said.

Risk management tools such as VaR, credit-risk models and faulty assumptions underestimated risk in the financial crisis — or as Mr. Jacobs also put it, "overestimated predictability."

"That's why many people were caught off guard," said Shafiq K. Ebrahim, principal with AJO LP, Philadelphia. "It's always hard to model these things when you have to try to foresee what may happen

in the future even though it hasn't happened in the past."

So institutional investors have been looking to refine existing risk measurement tools and use newer ones, seeking a better framework for measuring risk.

Many risk management tools, including VaR, failed to capture non-linear events in the markets, Mr. Jacobs said.

VaR is relatively "simple in concept and easy to calculate" — attributes in its widespread appeal, Mr. Jacobs said. But newer techniques require more complicated calculations, data and assumptions, he said.

Among them, network analysis "looks at how entities are connected to one another and how risk will propagate across these various connections," said Mr. Jacobs.

Connections include counterparty risks in swaps and other complex investments, but extend further in relationships among financial companies.

The challenge is getting the data to measure risk and connections across firms "because there is so much that is unknown," he said.

He added: "Managing and containing risk at an individual firm level can allow systemic risk to rise because of the interconnections between entities. Controlling risk at the individual entity level might not necessarily prevent systemic risk."

Mr. Ceria added that asset owners "are trying to figure out how they can measure and hedge their counterparty risk more effectively. You may have the perfect security (achieving a hedging goal), but if the underlying counterparty goes under for whatever reason" you might not be able to hedge your risk or recover your entire investment.

Agent-behavior analysis or agent-based analysis models financial markets from the bottom up. It "means determining how the behavior of agents" such as investors, analysts or traders "impacts asset prices," Mr. Jacobs said. It's designed to try to replicate the real world to simulate outcomes.

One challenge in developing risk tools is moving away from using normal distributions in modeling. Normal distribution "is a good first approximation," AJO's Mr. Ebrahim said. "For the most part it captures the general distribution of stock returns. … But it isn't ideal. We've known for a long time stock returns have fatter tails than the normal distribution."

"There are other distributions one can use that have fatter tails," or extend further out than a normal distribution that can lead to unexpected losses at the negative end, Mr. Ebrahim said.

Extreme value theory aims to tackle limitations of normal distribution, although it has its weakness. It "tries to model the tails using different types of distributions" other than a normal dispersal of returns, Mr. Ebrahim said. "That is something that is extremely hard to do because we don't have very many data points in the tails."

The reason is because there have been relatively few extreme events that extend to tails.

"We haven't seen in the past very many extreme observations," Mr. Ebrahim said. "But I think some of these techniques are better able

(at trying) to infer what those extreme events would look like.

"Unfortunately, the normal distribution is very easy to use," which is one of its most desirable properties, Mr. Ebrahim said. "That's why it's so commonly used." Other types of distributions "are more complex to deal with."

In addition, "some of the desirable properties we have with the normal distributions don't exist with some of these (other) distributions," Mr. Ebrahim said. For example, with a normal distribution "we have a well-defined mean and variance. That doesn't exist with" some other types.

Other limitations

There are other limitations with other distributions as well. They "don't correct for some of the problems we've seen in the past," such as liquidity issues, or modeling to include potential lack of liquidity, "and trying to model events we haven't already seen historically."

To assess risk more effectively, Axioma's Mr. Ceria said, asset owners "need to recognize some of the assets they hold have highly non-linear payoffs. They need to understand what those non-linear payoffs are in the context of certain scenarios and certain macroeconomic environments." To do so, they need to model "highly non-linear assets with highly non-linear models" because those assets will behave very differently subjected to step-by-step simulation, he said.

In a world of markets where there is so much availability of asset insurance, guarantees, default swaps and put options, even small price moves can lead to non-linear effects unpredicted by models, Mr. Jacobs said.

"Margin calls triggered by leverage can exacerbate non-linearities," he said. "Leverage risk should be recognized in portfolio construction."

Another risk management tool that might become more popular is expected shortfall risk, also known as expected tail loss. It is related to VaR, but "goes one step further," Mr. Ebrahim said. Given an extreme event, it would tell investors how much they might expect to lose.

"The (financial) crisis has … reinforced the importance of stress testing and scenario analysis for testing key model assumptions," Mr. Ebrahim said. Aside from specific approaches, "the increasing development of holistic enterprise risk management tools and customization of risk models … will also help investors better assess portfolio risk in the future."

Mr. Ceria expects more stress testing of portfolios "in a variety of ways along a variety of dimensions to let us know what will be the reaction to different scenarios."

"We are trying to deal with the notion that a lot of the risk assessment is something that has to happen in a very interactive framework," Mr. Ceria said. "You just don't provide a report with a number … you (have to be) able to run … stress tests and scenarios to try to answer questions that arise from your observations, of what is going on, the environment." ∎