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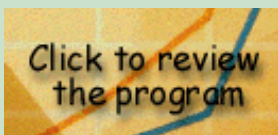
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## LTCM Speaks

In a series of secretive roadshows, LTCM partners now admit they badly misjudged market dynamics and volatility, making common risk management mistakes on a grand scale.

**By Joe Kolman**

The story of the fall of long term capital management has all the elements of a cheap financial thriller. Greedy financiers with platinum pedigrees create a superfirm with spectacular returns. But their high-stakes trading schemes push the financial world to the brink of collapse. After the failure of a last-minute low-ball bid by a daring billionaire, the Federal Reserve forces a consortium of banks into a bailout that saves the financial world from catastrophe.

The high drama is all too familiar to readers of the financial press. We know all about the background and ambitions of John Meriwether and the firm's other partners, its bread-and-butter relative-value trades and its quirky side bets on takeover stocks. Since the bailout, we've been told that the consortium of banks that have rescued the fund has reduced the risk in its portfolio by some 50 percent. And recently, we've heard that the fund has recovered to such an extent that it will return investment capital to the bailout partners much quicker than originally anticipated.

Despite all the hyperbole, the central mystery remains: How could some of the best minds in the financial world get it so wrong? Even with the reams of analysis, we still don't know how the partners thought about risk and what precisely went wrong with their risk management strategy. The firm, never friendly to the press, has become a walled fortress since the bailout. The information vacuum has allowed a series of rumors to go unchallenged and coalesce into firmly held beliefs.

The only member of the press who has received detailed briefing from LTCM is Michael Lewis, author of *Liar's Poker*, and arguably the nation's premier financial journalist. Lewis was allowed to interview the principals at length and pore over the firm's books. His article in the *Times Sunday Magazine* on January 24 gives a number of new insights into the drama, and includes a particularly vivid account of how rivals picked apart LTCM's portfolio like a piece of roadkill. But the piece, written for a general audience, did not attempt to explain the intricacies of LTCM's risk management strategy.

A few other people, however, have also been getting a peek behind the curtain. In recent months, partners from LTCM have been quietly making presentations to groups of investors and academics, explaining what they believe went wrong. These off-the-record discussions have been as secretive as an intelligence briefing. Participants are not permitted to take notes, and copies of the slide presentation are not distributed.

The presentations may be designed to rebuild investor confidence in preparation for a phoenix-like rebirth after the consortium packs its bags. They may also serve to establish an intellectual base of support in the academic community.

The roadshow has shed light on a number of unanswered questions, and audience members are now discussing the LTCM affair with new insight. By relying on people who have heard the presentations, it's possible to piece together LTCM's view of events. This article is based on such

information. LTCM has not responded to several requests for comment.

The conclusions to be drawn from LTCM's account and the reactions of industry experts are surprising. The firm's disastrous losses have led many people to assume that the firm simply didn't practice risk management. That couldn't be further from the truth. It has now become clear that LTCM used industry-standard risk management methodologies, but put undue reliance on value-at-risk numbers at the expense of stress testing. LTCM partners also admit the firm badly misjudged market dynamics and liquidity issues, and failed to reduce the firm's risk in the wake of losses. Readers looking to find a story of lunatic financiers run amok are bound to be disappointed. LTCM made a series of common risk management mistakes, but made them on a huge scale.

### **Preparing for trouble**

In January 1998, Long-Term Capital Management was of the world's most respected hedge funds. During the previous year, the firm decided to return \$2.7 billion to investors, explaining that investment opportunities in its core relative-value market had diminished. Many investors thought the explanation smelled like an excuse to push them out. If opportunities had decreased, why were the partners leaving their own money in the fund?

LTCM was perceived as the master of relative-value trading, which involves buying one instrument and simultaneously selling another. The theory was that the portfolio would make money on the increase or decrease in the spread between the two positions and would be unaffected by the absolute level of the instruments.

LTCM was not the only firm in the relative-value business. Salomon Brothers' proprietary trading desk, Meriwether's alma mater, was considered LTCM's closest cousin. But a number of hedge funds and bank trading desks were doing simplistic versions of its strategy. Although these firms didn't have the sophisticated models LTCM was thought to possess, opportunities were relatively easy to identify and a few relative value trades were widely held. LTCM's portfolio, however, was thought to be in a class by itself, built on opportunities that could be identified by only the most elaborate modeling techniques.

Like most players in the derivatives market, LTCM used a variety of risk management techniques, including value-at-risk, stress testing and scenario analysis. VAR analysis estimates the maximum loss that can be suffered at a certain level of confidence, often 95 percent or 99 percent. VAR numbers are estimated using historical information about volatility and correlation. The assumption is that the future will be approximately like the past.

LTCM's firm-wide VAR analysis analyzed the thousands of positions it held and generated predictions about the daily profit-and-loss volatility it was likely to face. During the beginning of 1998, LTCM managers say they carefully geared their portfolios so that the daily firm-wide P&L volatility remained at about \$45 million.

Risk managers were comforted by other statistics. According to LTCM models discussed in the roadshow, a 10 percent loss in its portfolio was judged to be a three-standard-deviation event—an event that would occur once in a thousand or so trading periods. A loss of 50 percent of its portfolio was unthinkable high. According to one of its estimates, the firm would have had to wait 10-to-the-30th days—several billion times the life of the universe—to experience that kind of loss. By massaging the data, and applying other, more conservative econometric techniques, it would have had to wait 10-to-the-ninth days.

Like most hedge funds, LTCM was prepared to adjust its portfolio risk when it suffered losses. If it lost 10 percent in a particular month, it had to be ready to take its risk down by an equivalent amount. If it lost another 10 percent the following month, it had to be prepared to do the same thing again and again.

This kind of portfolio adjustment is necessary to avoid a phenomenon called gamblers ruin. The goal

is to bet a constant proportion of your total capital instead of betting an absolute number. A gambler who starts out at the racetrack with \$10 and promptly loses \$5 would bet \$2.50 in the next race, and so on.

Although LTCM had presented itself as master of relative-value trading, it had strayed into a number of other trading specialties that were not market neutral, including risk arbitrage and emerging-market cash bonds. The firm also made big bets that volatility in European and U.S. stock indices would return to normal levels.

In early 1998, however, most of the firm's balance sheet was concentrated in government and agency securities and reverse repurchase agreements necessary for its core relative-value trading. Most of the firms that engaged in these types of trades at the time tended to buy lower-quality non-government bonds and short higher-quality government bonds. They performed this bond arbitrage by borrowing the bond they were short in the repo market and lending the bond they were long. LTCM also took positions involving the spread between off-the-run Treasuries (30-year securities with less than 30 years to maturity) and on-the-run Treasuries (newly minted 30-year bonds). Their strategy was designed to exploit the difference in yields that resulted from differences in liquidity rather than differences in credit quality.

Most arbitrageurs who perform these strategies suffer from a critical weakness: Although they may be able to borrow the bonds they need overnight, they have no assurance they'll be able to get them again the next night. The investor who loaned the bonds one night might decide to sell them the next, forcing traders executing the strategy to close out their positions. LTCM managers say they thought they had eliminated the risks on the firm's short bond positions. Instead of borrowing the bonds in the repo market, LTCM used its clout with banks to secure long-term financing of its short positions.

LTCM managers were also reassured by the presence of other participants in the relative-value game. "We put very little emphasis on what other leveraged players were doing, because I think we thought they would behave similarly to ourselves," partner Victor Haghani told Lewis. In other words, LTCM believed prices were not likely to fall dramatically because its competitors would continue to see long-term values and hold onto their positions when markets got rocky. Relative-value players often double-up on positions when prices drop on the assumption that they will return to normal, and LTCM may have assumed that LTCM competitors would buy aggressively instead of panicking during a market downturn.

LTCM managers say they were also reassured by the firm's degree of leverage. Although LTCM's leverage ratio eventually reached 100:1, its leverage before the crisis was about 25:1, with about \$4.7 billion in capital and \$125 billion in debt. In their post-bailout presentations, LTCM partners compared the firm's targeted 25:1 leverage during that period to the 34:1 leverage common at securities firms and the 24:1 leverage common at money-center banks. According to another LTCM explanation, the firm was trying to earn 1 percent on assets, leveraged 25 times, which would result in a 25 percent return.

### **The Summer of '98**

According to LTCM managers, the trouble began in May and June of last year. A downturn in the mortgage-backed securities market forced some key hedge funds to liquidate their emerging-market positions. Meanwhile, the Treasury bond market was rallying. That led to a general widening of credit spreads that inevitably put pressure on relative-value strategies, which are chronically short Treasuries.

LTCM was also feeling pressure on another front. During the same period, Salomon Brothers was quietly closing down its proprietary trading business. LTCM knew that Salomon was moving out of its positions, but misjudged the effect. LTCM may have thought that other relative-value players would step in to buy Salomon's positions. Few did, and the positions held by both firms sank like a stone.

LTCM experienced a 16 percent drop in its net asset value during May and June 1998, the first time it had experienced losses in two consecutive months. In a letter sent to investors at the time, Meriwether reported that “future expected returns are good.” In the roadshow presentation, the firm explains that it began moving out of positions in order to take the firm’s expected risk down from the \$45 million-a-day level closer to \$34 million a day.

The firm admits, however, that in doing so it made a critical mistake: Instead of taking every single position down 15 percent, it decided that some of the investments looked better than others, and took off the ones that looked the least attractive. The least-attractive positions tended to be the more liquid investments that generated modest returns. The highest-return trades, by contrast, were usually the funkiest and most illiquid.

At first, however, everything seemed fine. The models confirmed that the firm’s portfolio risk had been reduced from 45 percent to about 35 percent. The problem was that the portfolio had become much more illiquid, and the LTCM models did not take this into account. Reality inevitably caught up with the models. Instead of the \$35 million daily P&L volatility the models forecasted, managers say daily volatility soon reached \$100 million and higher. Something was clearly wrong with the way the firm was modeling its risk.

Then came August 1998, when the market moves were sharper than anything the firm had expected. On August 17, Russia announced it was restructuring its bond payments—a de facto default. The losses forced many investment banks, hedge funds and other institutional investors to reduce their positions en masse. The flight to quality boosted prices for Treasury bonds and sunk prices for lower quality bonds in an unprecedented fashion.

Credit spreads had never moved so far so fast. The most dramatic manifestation of the phenomenon was in swap spreads, which represent the differential in interest rates paid by high-grade banks and Treasury securities. Swap spreads had never moved more than two or three basis points in a two-day period. On the morning of August 21, 1998, they moved 21 basis points.

LTCM’s losses were breathtaking. On August 21 alone, the firm lost \$550 million.

In late August, the fund found itself down 44 percent for the year, with more than 80 percent of its losses in its core relative-value trades. The models had judged that kind of loss to be a 14-standard-deviation event, something that occurs once in several billion times the life of the universe. But the event had occurred within five years of the fund’s launch.

LTCM partners were particularly disturbed about their new leverage ratio. The losses in equity had made the firm involuntarily overleveraged. But the partners had not given up hope. Although the firm was undercapitalized, and involuntarily overleveraged, the partners believed they would not be threatened by margin calls. On top of that, they believed their trades looked great because, over time, the credit spreads would have to return to normal. In the face of total collapse, they decided to stick with their core strategy.

But something had to be done about the firm’s leverage ratio. It desperately needed to get more capital to shore up its \$100 billion in debt. With \$2.3 billion in equity, its leverage ratio was an abysmal 43:1. With \$1.5 billion in fresh capital—a total of \$3.8 billion—the ratio would be a more respectable 26:1.

In some respects, raising that kind of money was not a preposterous dream. In 1997, LTCM had forcibly returned \$2.7 billion to unwilling investors. Now it wanted to borrow some of it back. By this time, however, the firm’s P&L was moving \$100 million or \$200 million a day. And as the losses mounted, the firm needed more and more capital to survive.

The problem was timing. The \$1.5 billion had to be raised during the last week in August, a time when most of Europe was on vacation and most of Wall Street was in the Hamptons. But the firm had no choice. On September 1, LTCM was scheduled to announce its net asset value. Once it

revealed it was down 50 percent for the year, the financial world would rush to protect itself from an LTCM meltdown.

In retrospect, trying to raise \$1.5 billion during that particular week seems desperate, naïve or both. In the course of begging from Wall Street, the firm was forced to reveal many of its positions. And the more people knew about LTCM, the more eager the market was to protect itself from—and take advantage of—an LTCM collapse.

LTCM became the victim of a classic squeeze by the arbitrageurs it competed with. The drama of Wall Street sharks eating one of their own is chronicled in Lewis' Times article. According to Lewis, many Wall Street firms got out in front of LTCM's positions and made bundles of money—including A.I.G., which was trying to weaken LTCM's positions so it could buy its portfolio on the cheap.

"It was the trades that the market knew we had on that caused us trouble," Meriwether told Lewis. "It ceased to feel like people were liquidating positions similar to ours," agreed LTCM partner Richard Leahy. "All of a sudden they were liquidating our positions." According to Haghani, "It was as if there was someone out there with our exact portfolio, only it was three times as large as ours and they were liquidating all at once."

By mid-September of last year, it became clear the end was near. On September 21, two days before the consortium agreement, the firm's NAV dropped to below \$1 billion, with total assets above \$100 billion. The firm was leveraged more than 100:1. On September 23, capital adequacy was restored to the fund by 14 banks, which invested \$3.6 billion in return for a 90 percent stake in the firm.

### **Mistaken assumptions**

So what went wrong? In the various versions of their roadshow, LTCM partners have compiled an odd assortment of mea culpas. First, they now admit that they were not fully aware of market price dynamics. According to economic theory, a bond that is too cheap should attract buyers. But in a skittish market, lower prices can repel buyers. The firm also attempted to diversify its risk across a number of markets, but failed to recognize how those efforts would come to naught when other relative-value funds began liquidating similar positions.

Second, LTCM says it is now more aware of the importance of stress testing vis-à-vis VAR methodologies. In effect, the firm is arguing that its over-reliance on VAR methods did not allow it to anticipate how the markets would behave. VAR calculations are based on historical data, but the past is a poor guide to the future. In July 1998, Russia defaulted on its domestic debt but not on its foreign debt. Because an event of that nature had never occurred, a model would assign it a probability of zero. The risk is there; you just don't know what it is.

Third, LTCM now says it was surprised by how negatively correlated its returns were with liquidity. When the financial world decided to cut its risk exposure, global liquidity dried up and nobody wanted to take the other side of LTCM's trades. The firm also admits that when it was time to reduce its risk positions, it should have started selling off its funkier, illiquid holdings sooner.

Fourth, the firm has now concluded that its positions were simply too big for some of the markets it traded in. It estimates that cutting its positions by 50 percent wouldn't have been enough, but slashing its core positions to one-quarter of its size might have allowed it to squeak by.

On a broader note, the partners argue that the events of the summer of 1998 were impossible to predict, and that nothing in the historical data could have prepared them for what happened. The data were simply inadequate. "What we did is rely on experience," Haghani told Lewis. "And all science is based on experience. And if you're not willing to draw any conclusions from experience, you might as well sit on your hands and do nothing."

Elsewhere in the piece, strategist Ayman Hindy argues: "The models tell you where things will be in

five years. But they don't tell you what happens before you get to the moment of certainty." In other words, although there may be some certainty that the LTCM trades would pay off if held to maturity, there's no certainty about what would happen along the way.

### Common mistakes

Part of the intent of the LTCM roadshow was to stimulate debate about the risk management issues surrounding the firm's collapse. Risk managers, traders and academics who have heard LTCM's presentation have drawn different conclusions. Before the meltdown, they assumed that LTCM's relative-value trades were far more sophisticated than those of its competitors. But when details about the firm's portfolio finally emerged, audience members were shocked at the simplicity of the firm's trading ideas.

Roadshow attendees have a similar reaction to what LTCM says it learned from its experience. In most cases, they are basic principles that might be taught in Risk Management 201, lessons any sophisticated market participant should have been aware of.

LTCM, for example, says it was unprepared for the severity of the jump in credit spreads and the liquidity crisis that followed. But hedge funds had dumped liquid positions en masse many times, most notably in the fall of 1994, when investors liquidated German Bund positions in response to losses in less liquid Italian, Spanish and Australian government bonds. A simple flight-to-quality scenario could have modeled what might happen if investors bid up Treasuries through the roof. These scenarios may have been dutifully performed by LTCM risk managers and then dismissed as unlikely. LTCM also admits it mistakenly dumped liquid positions instead of selling off its more exotic positions. In doing so, it violated one of the core principles of dynamic trading.

Risk managers find it strange that LTCM was surprised by the collapse of its diversification strategies during the crisis. LTCM was certainly aware that other players held similar relative-value bets and that correlations tend to evaporate during periods of market stress. Why didn't the firm take this threat seriously enough?

They are also surprised that the firm relied so heavily on VAR, a methodology whose problems are well-documented. A number of firms, in fact, have moved away from VAR and have put more emphasis on stress testing and other methodologies.

### Spinning the LTCM Story

When New York Times reporter Michael Lewis made his way through the press blockade to interview the principals of LTCM, it was without the consent of the bank consortium orchestrating the bailout. "It was clear the consortium did not want me to be there, but once I was in, the damage was done," he says. "The consortium then decided that LTCM principals are not to talk to the press without their consent. I find that a little weird."

In Lewis' view, the consortium wants the world to see LTCM as an irresponsible hedge fund that became profitable only through its cleanup efforts. LTCM, by contrast, wants people to believe it made smart trades that hit a period of unusual market volatility but were ultimately profitable.

Since the consortium has controlled access to the press, Lewis believes that most of the reportage thus far has been prejudiced against LTCM. But he predicts that will change when the consortium leaves and LTCM becomes eager to restore its reputation and attract new money.

"Round 1 will show how brilliantly the consortium managed a way out of a crisis and controlled these lunatics," he explains. "Round 2 will come after the consortium leaves, when LTCM can have all the reporters in and explain that the consortium simply sat on top of bets they put on before the consortium arrived."

—J.K.

Others object to LTCM's framing of the problem as one of data gathering. LTCM managers say they couldn't calibrate their models effectively because the data they needed were inadequate. But even perfect data would not have helped them because the past is simply not adequate to predict the future. This inherent limitation in risk modeling is often corrected by risk limits that force managers to get out of positions when losses hit a certain level. But relative-value traders routinely avoid risk limits on the assumption that mispricings are temporary and will inevitably return to normal.

This confidence in the face of market phenomena may be the ultimate cause of LTCM's downfall. The firm's claims to scientific reasoning suffer from a critical weakness. LTCM was supremely confident of its ability to model risk. But a model, after all, is a hypothesis about market phenomena, and when scientific hypotheses are tested in the real world and don't measure up, they are modified or discarded. In July and August 1998, LTCM's models were predicting a daily P&L volatility of \$35 million. When actual volatility proved to be much higher, why didn't the firm modify or discard its models?

There were plenty of early warnings. Alarm bells should have been ringing in Greenwich, Conn., when risk models judged that an LTCM collapse would occur only once in an impossibly long time. Was an LTCM collapse truly a 15-sigma event? Or did the firm grossly misestimate the inputs to the models?

When LTCM was started, the principals went to great lengths to lock up enough capital to support their trading strategy. Yet they clearly failed to secure enough long-term capital to get the firm through the summer of 1998. LTCM mistakenly assumed that its principal liquidity risk would be from investor withdrawals following a big fund loss, and protected itself by locking up investors' capital for years at a time. It also assumed it could protect its short repo positions with long-term financing. But in the end, the firm was brought down when a foolhardy bet on takeover stocks triggered a gigantic margin call by Bear Stearns. Ultimately, the firm misjudged the expected duration of trades and the financing that supported them.

If LTCM had less leverage and more capital, it may have survived. Instead of going begging to Wall Street and revealing its positions, the firm could have simply announced a 50 percent drop in NAV and waited until the market returned. In hindsight, of course, the fund shouldn't have given back that \$2.7 billion in 1997.

During the crisis, LTCM saw dozens of tantalizing trading opportunities it didn't have the resources to pursue. Since the bailout, many of the LTCM's original positions have turned into big money makers, and partners say there are still plenty of opportunities to exploit. Although LTCM made some disastrous risk management mistakes, the partners may have been right. On Wall Street, however, being right doesn't matter if you don't have enough money. The final irony may be that Long-Term Capital Management didn't have enough long term capital.

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