LTCM Case Study

Summary:
In 1994, John Meriwether, the famed Salomon Brothers bond trader, founded a hedge fund called Long-Term Capital Management. Meriwether assembled an all-star team of traders and academics in an attempt to create a fund that would profit from the combination of the academics' quantitative models and the traders' market judgement and execution capabilities. Sophisticated investors, including many large investment banks, flocked to the fund, investing $1.3 billion at inception. But four years later, at the end of September 1998, the fund had lost substantial amounts of the investors' equity capital and was teetering on the brink of default. To avoid the threat of a systemic crisis in the world financial system, the Federal Reserve orchestrated a $3.5 billion rescue package from leading U.S. investment and commercial banks. In exchange the participants received 90% of LTCM's equity.

The lessons to be learned from this crisis are:

- Market values matter for leveraged portfolios;
- Liquidity itself is a risk factor;
- Models must be stress-tested and combined with judgement; and
- Financial institutions should aggregate exposures to common risk factors.

Overview:
LTCM seemed destined for success. After all, it had John Meriwether, the famed bond trader from Salomon Brothers, at its helm. Also on board were Nobel-prize winning economists Myron Scholes and Robert Merton, as well as David Mullins, a former vice-chairman of the Federal Reserve Board who had quit his job to become a partner at LTCM. These credentials convinced 80 founding investors to pony up the minimum investment of $10 million apiece, including Bear Sterns President James Cayne and his deputy. Merrill Lynch purchased a significant share to sell to its wealthy clients, including a number of its executives and its own CEO, David Komansky. A similar strategy was employed by the Union Bank of Switzerland (The Washington Post, 9/27/98).

LTCM's main strategy was to make convergence trades. These trades involved finding securities that were mispriced relative to one another, taking long positions in the cheap ones and short positions in the rich ones. There were four main types of trade:

- Convergence among U.S., Japan, and European sovereign bonds;
- Convergence among European sovereign bonds;
- Convergence between on-the-run and off-the-run U.S. government bonds;
- Long positions in emerging markets sovereigns, hedged back to dollars.

Because these differences in values were tiny, the fund needed to take large and highly-leveraged positions in order to make a significant profit. At the beginning of 1998, the fund had equity of $5 billion and had borrowed over $125 billion — a leverage factor of roughly thirty to one. LTCM's partners believed, on the basis of their complex computer models, that the long and short positions were highly correlated and so the net risk was small.
**Events:**

1994: Long-Term Capital Management is founded by John Meriwether and accepts investments from 80 investors who put up a minimum of $10 million each. The initial equity capitalisation of the firm is $1.3 billion. (The Washington Post, 27 September 1998)

End of 1997: After two years of returns running close to 40%, the fund has some $7 billion under management and is achieving only a 27% return — comparable with the return on US equities that year.

Meriwether returns about $2.7 billion of the fund's capital back to investors because "investment opportunities were not large and attractive enough" (The Washington Post, 27 September 1998).

Early 1998: The portfolio under LTCM's control amounts to well over $100 billion, while net asset value stands at some $4 billion; its swaps position is valued at some $1.25 trillion notional, equal to 5% of the entire global market. It had become a major supplier of index volatility to investment banks, was active in mortgage-backed securities and was dabbling in emerging markets such as Russia (Risk, October 1998)

17 August 1998: Russia devalues the rouble and declares a moratorium on 281 billion roubles ($13.5 billion) of its Treasury debt. The result is a massive "flight to quality", with investors flooding out of any remotely risky market and into the most secure instruments within the already "risk-free" government bond market. Ultimately, this results in a liquidity crisis of enormous proportions, dealing a severe blow to LTCM's portfolio.

1 September 1998: LTCM's equity has dropped to $2.3 billion. John Meriwether circulates a letter which discloses the massive loss and offers the chance to invest in the fund "on special terms". Existing investors are told that they will not be allowed to withdraw more than 12% of their investment, and not until December.

22 September 1998: LTCM's equity has dropped to $600 million. The portfolio has not shrunk significantly, and so its leverage is even higher. Banks begin to doubt the fund's ability to meet its margin calls but cannot move to liquidate for fear that it will precipitate a crisis that will cause huge losses among the fund's counterparties and potentially lead to a systemic crisis.

23 September 98: Goldman Sachs, AIG and Warren Buffett offer to buy out LTCM's partners for $250 million, to inject $4 billion into the ailing fund and run it as part of Goldman's proprietary trading operation. The offer is not accepted. That afternoon, the Federal Reserve Bank of New York, acting to prevent a potential systemic meltdown, organises a rescue package under which a consortium of leading investment and commercial banks, including LTCM's major creditors, inject $3.5-billion into the fund and take over its management, in exchange for 90% of LTCM's equity.

Fourth quarter 1998: The damage from LTCM's near-demise was widespread. Many banks take a substantial write-off as a result of losses on their investments. UBS takes a third-quarter charge of $700 million, Dresdner Bank AG a $145 million charge, and Credit Suisse $55 million. Additionally, UBS chairman Mathis Cabiallavetta and three top executives resign in the wake of the bank's losses (The Wall Street Journal Europe, 5 October 1998). Merrill Lynch's global head of risk and credit management likewise leaves the firm.

April 1999: President Clinton publishes a study of the LTCM crisis and its implications for systemic risk in financial markets, entitled the President's Working Group on Financial Markets (Governance and Risk Control-Regulatory guidelines-president's working group)
Analysis:

The Proximate Cause: Russian Sovereign Default

The proximate cause for LTCM’s debacle was Russia’s default on its government obligations (GKO). LTCM believed it had somewhat hedged its GKO position by selling rubles. In theory, if Russia defaulted on its bonds, then the value of its currency would collapse and a profit could be made in the foreign exchange market that would offset the loss on the bonds.

Unfortunately, the banks guaranteeing the ruble hedge shut down when the Russian ruble collapsed, and the Russian government prevented further trading in its currency. (The Financial Post, 9/26/98). While this caused significant losses for LTCM, these losses were not even close to being large enough to bring the hedge fund down. Rather, the ultimate cause of its demise was the ensuing flight to liquidity described in the following section.

The Ultimate Cause: Flight to Liquidity

The ultimate cause of the LTCM debacle was the “flight to liquidity” across the global fixed income markets. As Russia’s troubles became deeper and deeper, fixed-income portfolio managers began to shift their assets to more liquid assets. In particular, many investors shifted their investments into the U.S. Treasury market. In fact, so great was the panic that investors moved money not just into Treasurys, but into the most liquid part of the U.S. Treasury market -- the most recently issued, or "on-the-run" Treasuries. While the U.S. Treasury market is relatively liquid in normal market conditions, this global flight to liquidity hit the on-the-run Treasuries like a freight train. The spread between the yields on on-the-run Treasuries and off-the-run Treasuries widened dramatically: even though the off-the-run bonds were theoretically cheap relative to the on-the-run bonds, they got much cheaper still (on a relative basis).

What LTCM had failed to account for is that a substantial portion of its balance sheet was exposed to a general change in the "price" of liquidity. If liquidity became more valuable (as it did following the crisis) its short positions would increase in price relative to its long positions. This was essentially a massive, unhedged exposure to a single risk factor.

As an aside, this situation was made worse by the fact that the size of the new issuance of U.S. Treasury bonds has declined over the past several years. This has effectively reduced the liquidity of the Treasury market, making it more likely that a flight to liquidity could dislocate this market.

Systemic Risk: The Domino Effect

The preceding analysis explains why LTCM almost failed. However, it does not explain why this near-failure should threaten the stability of the global financial markets. The reason was that virtually all of the leveraged Treasury bond investors had similar positions: Salomon Brothers, Merrill Lynch, the III Fund (a fixed-income hedge fund that also failed as a result of the crisis) and likely others.

There were two reasons for the lack of diversity of opinion in the market. The first is that virtually all of the sophisticated models being run by the leveraged players said the same thing: that off-the-run Treasuries were significantly cheap compared with the on-the-run Treasuries. The second is that many of the investment banks obtained order flow information through their dealings with LTCM. They therefore would have known many of the actual positions and would have taken up similar positions alongside their client.

Indeed, one industry participant suggested that the Russian crisis was the crowning blow on a domino effect that had started months before. In early 1998, Sandy Weill, as co-head of
Citigroup, decided to shut down the famous Salomon Brothers Treasury bond arbitrage desk. Salomon, one of the largest players in the on-the-run/off-the-run trade, had to begin liquidating its positions. As it did so, these trades became cheaper and cheaper, putting pressure on all of the other leveraged players.

**Lessons to be learned:**

*Market values matter*

LTCM was perhaps the biggest disaster of its kind, but it was not the first. It had been preceded by a number of other cases of highly-leveraged quantitative firms that went under in similar circumstances.

One of the earliest was Franklin Savings and Loan, a hedge fund dressed down as a savings & loan. Franklin's management had figured out that many of the riskier pieces of mortgage derivatives were undervalued because a) the market could not understand the risk on the risky pieces; and b) the market overvalued those pieces with well-behaved accounting results. Franklin decided it was willing to suffer volatile accounting results in exchange for good economics.

More recently, the Granite funds, which specialised in mortgage-backed securities trading, suffered as the result of similar trading strategies. The funds took advantage of the fact that "toxic waste" (risky tranches) from the mortgage derivatives market were good economic value. However, when the Fed raised interest rates in February 1994, Wall Street firms rushed to liquidate mortgage-backed securities, often at huge discounts.

Both of these firms claimed to have been hedged, but both went under when they were "margin-called". In Franklin's case, the caller was the Office of Thrift Supervision; in the Granite Fund's, the margin lenders. What is the common theme among Franklin, the Granite Funds and LTCM? All three depended on exploiting deviations in market value from fair value. And all three depended on "patient capital" -- shareholders and lenders who believed that what mattered was fair value and not market value. That is, these fund managers convinced their stakeholders that because the fair values were hedged, it didn't matter what happened to market values in the short run — they would converge to fair value over time. That was the reason for the "Long Term" part of LTCM's name.

The problem with this logic is that capital is only as patient as its least patient provider. The fact is that lenders generally lose their patience precisely when the funds need them to keep it — in times of market crisis. As all three cases demonstrate, the lenders are the first to get nervous when an external shock hits. At that point, they begin to ask the fund manager for market valuations, not models-based fair valuations. This starts the fund along the downward spiral: illiquid securities are marked-to-market; margin calls are made; the illiquid securities must be sold; more margin calls are made, and so on. In general, shareholders may provide patient capital; but debt-holders do not.

The lesson learned from these case studies spoils some of the supposed "free lunch" features of taking liquidity risk. These plays can indeed generate excellent risk-adjusted returns, *but only if held for a long time*. Unfortunately the only real source of capital that is patient enough to take fluctuations in market values, especially through crises, is equity capital.

In other words, you can take liquidity bets, but you cannot leverage them much.

*Liquidity risk is itself a factor*

As pointed out in the analysis section of this article, LTCM fell victim to a flight to liquidity. This
phenomenon is common enough in capital markets crises that it should be built into risk models, either by introducing a new risk factor — liquidity — or by including a flight to liquidity in the stress testing (see the following section for more detail on this). This could be accomplished crudely by classifying securities as either liquid or illiquid. Liquid securities are assigned a positive exposure to the liquidity factor; illiquid securities are assigned a negative exposure to the liquidity factor. The size of the factor movement (measured in terms of the movement of the spread between liquid and illiquid securities) can be estimated either statistically or heuristically (perhaps using the LTCM crisis as a "worst case" scenario).

Using this approach, LTCM might have classified most of its long positions as illiquid and most of its short positions as liquid, thus having a notional exposure to the liquidity factor equal to twice its total balance sheet. A more refined model would account for a spectrum of possible liquidity across securities; at a minimum, however, the general concept of exposure to a liquidity risk factor should be incorporated in to any leveraged portfolio.

**Models must be stress-tested and combined with judgement**

Another key lesson to be learnt from the LTCM debacle is that even (or especially) the most sophisticated financial models are subject to model risk and parameter risk, and should therefore be stress-tested and tempered with judgement. While we are clearly privileged in exercising 20/20 hindsight, we can nonetheless think through the way in which judgement and stress-testing could have been used to mitigate, if not avoid, this disaster.

According to the complex mathematical models used by LTCM, the positions were low risk. Judgement tells us that the key assumption that the models depended on was the high correlation between the long and short positions. Certainly, recent history suggested that correlations between corporate bonds of different credit quality would move together (a correlation of between 90-95% over a 2-year horizon). During LTCM's crisis, however, this correlation dropped to 80%. Stress-testing against this lower correlation might have led LTCM to assume less leverage in taking this bet.

However, if LTCM had thought to stress test this correlation, given that it was such an important assumption, it would not even have had to make up a stress scenario. This correlation had dropped to 75% as recently as 1992 (Jorion, 1999). Simply including this stress scenario in the risk management of the fund might have led LTCM to assume less leverage in taking this bet.

**Financial institutions must aggregate exposures to common risk factors**

One of the other lessons to be learned by other financial institutions is that it is important to aggregate risk exposures across businesses. Many of the large dealer banks exposed to a Russian crisis across many different businesses only became aware of the commonality of these exposures after the LTCM crisis. For example, these banks owned Russian GKOs on their arbitrage desks, made commercial loans to Russian corporates in their lending businesses, and had indirect exposure to a Russian crisis through their prime brokerage lending to LTCM. A systematic risk management process should have discovered these common linkages ex ante and reported or reduced the risk concentration.