THE NEAR CRASH OF 1998[†]

Crisis and Risk Management

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From theory, alternative investments require a premium return because they are less liquid than market investments. This liquidity premium varies considerably over time as a function of preferences, leverage technology, the developments in financial technology, and changes in institutional arrangements. The dynamics of the liquidity premium depend on institutional reactions to financial crises.

During 1997–1998, we have seen the movement of a financial crisis around the world. It started in Southeast Asia, moved through Latin America, and then visited Russia and returned again to South America. The financial crisis has also infected Europe and the United States, especially during August–October 1998.

The increase in volatility (particularly in the equity markets) and the flight to liquidity around the world resulted in an extraordinary reduction in the capital base of the firm that I was associated with, Long-Term Capital Management (LTCM). This reduction in capital culminated in a form of negotiated bankruptcy. A consortium of 14 institutions, with outstanding claims against LTCM, infused new equity capital into LTCM and took over it and the management of its assets. They hired LTCM's former employees to manage the portfolio under their direct supervision and with sufficient incentives to undertake the task efficiently.

Although the Federal Reserve Bank (FRB) facilitated the takeover, it did not bail out LTCM. Many debtor entities found it in their self-interest not to post the collateral that was owed to LTCM, and other creditor entities claimed to be ahead of others to secure earlier payoffs. Without the FRB acting quickly to mitigate these holdup activities, LTCM would have had to file for bankruptcy—for some, a more efficient outcome, but a far more costly outcome for society. If there was a bailout, it failed: LTCM has been effectively liquidated.

Because of LTCM, the press and others have taken the opportunity to criticize financial modeling, and in particular, the value of option-pricing models. In truth, mathematical models and option-pricing models played only a minor role, if any, in LTCM's failure. At LTCM, models were used to hedge local risks. LTCM was in the business of supplying liquidity at levels that were determined by its traders. In 1998, LTCM had large positions, concentrated in less liquid assets. As a result of the financial crisis, LTCM was forced to switch from being a large supplier to being a large demander of liquidity, at a cost that eliminated its capital.

Although the Russian default, the LTCM bankruptcy, and the financial difficulties of other financial-service firms are the most visible manifestations of the crisis of the late summer and fall of 1998, to this day we observe much greater volatility and lack of liquidity in many debt-related and equity-related financial markets. For example, during the summer of 1999, 3–5-year-long dated volatility on the Standard and Poor's (S&P) 500 index was quoted in the 25–30-percent range, average volatility levels on the S&P index that have not been seen before. To be consistent with market expectations, the realized quarterly volatility on an annualized basis on the S&P 500 would have to average 30 percent over the next five years, and even higher levels starting one year from now, since the current quoted one-year volatility is far less than 30 percent. In my view, this is extremely unlikely, even given the evolving nature of the stocks that make up the index. To put this in perspective, the quarterly realized volatility

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on the S&P 500 has averaged well below 15 percent over the last 10 years and has never averaged more than 25 percent in any five-year period.

In addition, credit spreads and mortgage spreads have widened dramatically. Although spreads narrowed somewhat early in 1999, during the summer of 1999 they widened to even higher levels than those of August–September 1998. For these spreads to be default premiums, the market must expect large numbers of defaults, and defaults with little chance of recovery.

Moreover, during August 1999, the 10-year-on-the-run swap spread was as high as 112 basis points over treasuries, more than 15 basis points greater than at the height of the September 1998 crisis. These spread levels are extraordinary in that swap spreads were generally in the high 20's to the low 30's from 1992 to mid-1998, and never reached this level, even in 1990 when banks including Citicorp and Bank of America were experiencing extreme difficulties.

It is hard to believe that these spread levels are attributable only to expectations of defaults in the credit market. Take the off-the-run swap spread as an example. The London Interbank Borrowing-Offer Rate (LIBOR) is set for a time frame, say, three months, by averaging the quoted borrowing rates on a truncated set of the then 16 top-rated banks in the world, and it does not depend on the survivorship of any particular bank. That is, if a bank were to become risky because its own prospects had diminished, it would be excluded from the computation of the next LIBOR index. Thus, for swap spreads to be entirely credit spreads, the market must perceive that the entire worldwide banking sector is to experience difficult times. What is even more amazing is that this perception would have to be true not for this coming year, but for nine years starting one year from now. Currently one-year LIBOR is quoted at only 25–35 basis points over general-collateral-reverse repurchase agreements (reverse REPO). That is, to borrow Treasury bonds to sell to someone else in the market and to return similar bonds to the lender, the bond borrower would receive about 30 basis points below LIBOR. Thus, for the swap spread to be a credit spread, LIBOR must increase dramatically relative to REPO, on average, during the nine years starting one year from now.

If these spreads are not entirely credit-related, they must be liquidity spreads. At different times the market demands more liquidity and will pay for it. During the last two years, the number of liquidity providers diminished. Many financial institutions that previously devoted part of their capital to earning returns by supplying liquidity to the market withdrew from doing such or would only commit capital at much higher expected premiums. To provide liquidity, an investor must have a longer horizon than the average market participant. Interestingly, because the liquidity premium is generally small relative to the expected return on alternative investments, liquidity providers are generally leveraged investors that must hedge other factor exposures. For them, risk management is of crucial importance, particularly during a crisis, when both credit risk and liquidity risk premiums balloon.

I. Risk Management

Understanding risk-management technology provides insights into the dynamics of liquidity premiums in asset returns. The risk-management practice at large financial institutions such as Citicorp or Merrill Lynch affects the supply of liquidity and therefore the required liquidity premium. As liquidity premiums change, credit spreads and other spreads increase in the debt and equity markets around the world.

For a financial institution, a conventional balance sheet does not provide adequate information to insiders or to outsiders such as investors or creditors as to the risk of the entity. Balance-sheet leverage is a reduced-form static measure of risk; it provides no forecast of the firm's profit and loss as economic factors unfold in the economy.

A risk-management system is an exposure-accounting system and a control system. An exposure-accounting system is a dynamic system that gives managers an opportunity to assess the effects of changes in economic factors such as interest-rate movements, yield-curve shifts and reshaping, currency and commodity price moves, and stock price movements, on the economic profit and loss of the entity. It determines the firm's need for capital to support its positions.

During the last five or so years, value-at-risk (VAR) has become an accepted standard in the

financial industry. It forms the basis for determining a bank's regulatory capital for market risk. Many financial entities use VAR as a dynamic risk measure, and VAR is often disclosed to investors. This approach to exposure accounting assumes that the future movements in risk factors are similar to past movements. That is, the variances and correlation matrix among factor exposures affecting profit and loss do not change over time. They are assumed to be stationary and normally distributed. The VAR measure is a probabilistic measure of loss potential, measured over a specified holding period and to a specified level of statistical confidence. For example, the VAR might be computed to be $100 million for a two-week period with 99-percent probability. Loosely put, there is about a 1-percent chance that a loss greater than $100 million would be sustained in the next two weeks.

Correlation patterns and variances, however, are not stationary, especially when market prices move dramatically. Factors that might exhibit low levels of correlation or association most of the time appear to be highly correlated in volatile times. When the value of nearly all asset classes are moving in lockstep, diversification is not helpful in reducing risk. The actual realized correlation patterns appear to be close to 1. In these times, the volatility of profit and losses will be far greater than VAR would predict. As well, liquidity and risk premiums change dramatically, resulting in far greater measured asset volatility.

In periods of extreme market stress, such as 1987 around the world, 1990 in Japan, 1991 in Europe, 1992 in Sweden, 1994 in the United States, 1995 in Mexico, and 1997–1999 in Asia and the Americas, Europe, and the United States, many statistically uncorrelated activities using historical data exhibited high degrees of association. For example, in 1998 the spreads over treasuries widened on U.S. AAA bonds, AAA commercial mortgage pools, credit instruments, country risks, and swap contracts. Moreover, volatilities on stock and bonds increased to levels that had not been observed in decades.

For example, on 21 August 1998, one week after Russia defaulted on its debt, swap spreads (the difference between AA bank risk and government bonds in the 10-year sector) shot up from 60 basis points to 80 basis points in one day. This 20-basis-point change was a move of 10 standard deviations in the swap spread. After this date the volatility of the swap spread increased from 0.8 of a basis point per day to 8 basis points per day, and it remained high throughout 1999.

To protect against extreme shocks such as these, many financial entities impose stress-loss limits on their portfolios. These stress limits attempt to protect against extreme shocks in individual risk factors, as well as groups of risk factors. Their intent is to capture more extreme moves, the so-called "tail exposures." These stress limits might preclude the entity from concentrating in any one strategy or project, or from maintaining a position even though additional or continued investment had expected positive present value when using conventional present-value analysis to decide its worth.

Before the financial crisis in August 1998, most financial institutions were well within the guidelines for capital adequacy specified by the Bank for International Settlements (BIS) on standard measures such as VAR, leverage, or tier-I or tier-II capital. Then in August, investors rushed to more liquid securities, increasing the demand and price of liquidity around the world. Investors liquidated large portfolios of assets in Asia and Latin America by selling into a market with high transaction costs. Many leveraged investors were forced to liquidate holdings to cover margin requirements.

Maybe part of the blame for the flight to liquidity lies with the International Monetary Fund (IMF). Investors believed that the IMF had given implicit guarantees to protect their investments against country-specific risks in the underdeveloped and less-developed regions of the world. But when Russia defaulted on its debt obligations, market participants realized that the implicit guarantees were no longer in place.

In an unfolding crisis, most market participants respond by liquidating their most liquid investments first to reduce exposures and to reduce leverage. Transaction costs including spreads tend to be smaller in these markets. Since it is not possible to know the extent of the unfolding crisis, holding and not selling the less liquid instruments is similar to buying an option to hold a position. More liquid markets tend to be large and can handle large trading volumes

relatively quickly. However, after the liquidation, the remaining portfolio is most likely unhedged and more illiquid. Without new inflows of liquidity, the portfolio becomes even more costly to unwind and manage.

There has been little modeling of the stress-loss liquidity component of risk management and its implication for the price of liquidity. Financial institutions use stress-loss limits and capital cushions to mitigate crisis risk. They have moved from a static risk measure (leverage) to a dynamic risk measure (VAR) with a static overlay (a stress-loss cushion) to provide an extra capital reserve in the event of a stress loss. A static risk measure, however, is not time-consistent. In a dynamic world, a dynamic policy is required that describes what actions to take as the cushion deteriorates or after it has been breached.

As is commonly known, as the adjustment gap between the stop-loss threshold (demanding liquidity) and the price at which one reacquires the position (providing liquidity) becomes small enough, the strategy is equivalent to replicating an option in the Black-Scholes world. Thus, a dynamic stop-loss policy values an option.

A put option provides the equivalent of a dynamic liquidity cushion. A put-protected position self-liquidates as money is lost and markets become more illiquid. The cost of this protection is the value of liquidity. In reality, put options replace the role of the static stress cushion.

Conceptually, to value risk or to price reserves for its position, an entity must value the options it is not buying to protect itself in the event that it has an increased demand for liquidity. Since the stress limit is not priced, this tends to create the wrong capital-allocation incentives within financial entities.

If an entity buys options, it protects itself against negative jumps in asset values. If, however, it establishes its own reserves, they must increase as position values fall, thereby forcing a dynamic adjustment to reserves. The cushion, so to speak, must be dynamic. The entity, however, by dynamically hedging on its own account, cannot protect itself entirely. Gaps or jumps (unless of specific forms) cannot be hedged by employing internal dynamic adjustments. However, this dynamic cushion is superior to the static risk cushions.

Many financial products have two-way markets. Financial entities enter into long and short contracts with customers and with other institutions. Because the entities' exposures tend to net, the net risk position is quite low. This activity is called a matched book or agency business. The gross number of positions, however, becomes quite large. In addition, to reduce credit risk, many dealers and sophisticated entities post collateral to each other on price moves in the amount of the payment that would have to be made to a counterpart on a forced liquidation.

For many of its proprietary products, however, a financial entity needs to hedge risks by using the bond or equity markets. In a market crisis, the greatest losses most likely occur in this hedged-book business. In August 1998, those who were receiving in swaps and hedging by shorting government issues or selling long-dated options and hedging by buying equity forwards suffered the greatest loss as spreads widened dramatically. The hedged-books suffered loss because of changes in the economic fundamentals and because of an unanticipated jump in the demand for liquidity. Again in the summer of 1999, as corporations and other entities had been issuing bonds or hedging an anticipated increase in interest rates, the demand for liquidity increased with a decrease in institutional supply, as these institutions also demanded liquidity. Stress-loss cushions were violated, and many financial entities reduced the size of their hedged-book positions at significant liquidation costs. Because the stress-loss cushions are static, entities have an ill-defined policy on when to supply liquidity and in what amounts. As a result, banks and financial entities are not the natural suppliers of liquidity, and they add to the volatility in financial crises.

II. Conclusion

Over the last several years, regulators have encouraged financial entities to use portfolio theory to produce dynamic measures of risk. VAR, the product of portfolio theory, is used for short-run day-to-day profit and loss-risk exposures. Now is the time to encourage the BIS and other regulatory bodies to support studies on stress-test and concentration methodologies. Planning for crises is more important than VAR

analysis. Furthermore, such new methodologies are the correct response to recent crises in the financial industry.

The financial industry will become more creative in supplying or finding a source of supply of "liquidity" options and contingent capital to supply liquidity in times of stress. As the reinsurance market has developed for excess loss, similar markets could develop and add value in financial markets. This becomes an important role for alternative investments. The financial industry's use of the stop-loss technology produces volatility in liquidity premiums in many financial instruments. It takes time, however, to develop new products and to educate potential new entrants into the market to utilize them. More dynamic cushions will reduce the fluctuations in the price of liquidity, and markets will become less prone to a financial crisis. The marketplace will find alternative providers and ways to supply liquidity.

From time to time, it is argued that financial quantitative modeling has failed because, even with the increase in measurement techniques, their use has not precluded financial crises or financial failures. Financial crises are prevalent throughout time and across countries. Although this might seem somewhat discouraging and a slam against financial modeling, it is not. This is so because better risk-measurement models reduce costs, and as a result, financial firms develop new products and activities that make their constituents better off. Most likely, these new developments increase risk levels once again. As costs fall, economics predicts that agents will move to the envelope once again.