Editor's Viewpoint: Battling Systemic Risk

f anything positive is emerging from the credit crisis, it is surely an increased awareness of the real threat of systemic risk. But how should we manage systemic risk now that denial is no longer an option?

Should banks be forced to be more liquid, or should regulators be empowered to be more proactive? Will better internal risk models lead to risk taking that is more efficient? Should structured products be banned altogether or should a centralized credit default swap (CDS) clearinghouse be built?

Clearly, there is no panacea for systemic risk. Rather, the most effective weapon will be an integrated and cooperative combination of analytic, regulatory and structural elements.

We may certainly begin by tearing down the simplistic value-at-risk (VaR) calculations based on historical price movements. In August 2007, Goldman Sachs chief financial officer David Viniar revealed the key flaw in this telling remark about the

Global Alpha hedge fund: "We were seeing things that were 25-standard deviation moves, several days in a row."¹

The mathematical impossibility of that outcome suggests that the null hypothesis of "correct risk models" may be roundly rejected. The July 2008 paper, "Crisis and Non-Crisis Risk in Financial Markets: A Unified Approach to Risk Management," by Robert Litzenberger and David Modest, addresses this issue and proposes a financial "risk management metric that more accurately measures potential exposures to financial crises and also captures volatility during non-crisis times."

This paper recalls the unlearned lessons of numerous financial crises, considering those that were directional in nature and those that were strategy-based. The result of the authors' review is a regime-shifting model that should give banks and hedge funds a better view of their tail risks that accounts for capital risks, such as crowding and simultaneous liquidation.

VaR is not the only model facing criticism. Credit correlation models are also being scrutinized. The October 2008 paper, "The Economics of Structured Finance," by Joshua Coval, Jakub Jurek and Erik Stafford, reviews the degree to which structured-product risk assessments depend on underlying asset risk assessments and correlations. In particular, the authors rationalize how a structured product can have a stand-alone default probability equivalent to a AAA security but have a critically different risk profile due to asset correlation dynamics. Their conclusions about mispricing and faulty risk assessments are well founded and instructive and should change the way investors evaluate structured products.

Correlation also gets a regulatory jab from "CoVaR," a September 2008 Federal Reserve Bank of New York staff report (#348) by Tobias Adrian and Markus Brunnermeier. They propose a measure of conditional-bank VaR that varies as a function of the VaR levels of other banks. Using their risk measure, the authors find that individual commercial banks have conditional VaR levels that are 43% higher on average than their individual VaRs. This suggests correlation in bank risks, a key systemic risk indicator.

Adrian and Brunnermeier also propose an integrated reporting scheme that requires banks or central banks to disclose more to regulators about the correlated nature of their risks, which would allow regulators to take early and preemptive action.

The theoretical models of financial institution liquidity and solvency are under intense scrutiny. Having seen systemic financial institution weakness, we must address the stability of exchanges whose members are primarily financial institutions. This issue is addressed by Robert Jones and Christophe Pérignon in their November 2008 paper: "Derivatives Clearing and Systemic Risk."

Finally, we need to question the root causes of liquidity risk. In "Endogenous Systemic Liquidity Risk," Jin Cao and Gerhard Illing argue that the existence of a government-supplied liquidity backstop encourages banks to free-ride and overinvest in illiquid assets. While there is no easy solution for this problem, the authors argue "it is crucial for efficient lenders of last resort policy to impose ex-ante minimum liquidity standards for banks." We need to be sure that the solutions we build for systemic risk reduction do not, in themselves, create different kinds of systemic risk.

These five papers represent an excellent starting point for risk managers seeking guidance on the assessment and management of systemic risk. >>

FOOTNOTES

1."Goldman pays the price of being big," Financial Times, August 13, 2007. Reprinted in Litzenberger and Modest.

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David C. Shimko

Extended Abstracts

Crisis and Non-Crisis Risk in Financial Markets: A Unified Approach to Risk Management

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This paper builds on the lessons from recent financial crises to develop an analytically tractable risk-management metric that more accurately measures potential exposures to financial crises and also captures volatility during noncrisis times. We develop a multiple-regime stress-loss risk framework that assumes markets are characterized by quiescent (non-crisis) periods most of the time, interspersed with infrequent crisis periods where four to five sigma events can occur with non-negligible probabilities.

The framework is flexible and can incorporate an arbitrary number of crises. One of the primary lessons of the strategy-based crises of 1998 and 2007 is that returns can be correlated due to the capital underlying a collection of trades (or strategies), regardless of any underlying economic rationale. This is an important feature of our model. We include crises that are directional in nature and capture severe directional moves, such as those that occurred in 1994 and 1987.

We show how the model can be used to decompose the risk of a portfolio between crisis and non-crisis risk and how to break down the strategy (or individual asset) contributions to these two types of risk.

The model is also used, á la Black Litterman, to examine the expected returns that are consistent with a given portfolio allocation and how expected returns need to change to justify a portfolio tilt away from an initial allocation. The paper discusses the practical implementation of the model in the context of a fund of hedge funds manager.

The Economics of Structured Finance

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The essence of structured finance activities is the pooling of economic assets (e.g., loans, bonds, mortgages) and the subsequent issuance of a prioritized capital structure of claims, known as tranches, against these collateral pools. As a result of the prioritization scheme used in structuring claims, many of the manufactured tranches are far safer than the average asset in the underlying pool.

We examine how the process of securitization allowed trillions of dollars of risky assets to be transformed into securities that were widely considered to be safe and argue that two key features of the structured finance machinery fueled its spectacular growth.

First, we show that tranches can only receive high credit ratings if the rating agencies are extraordinarily confident about their ability to estimate the underlying securities' default risks. We also show how likely defaults were to be correlated. Using the prototypical structured finance security - the collateralized debt obligation (CDO) - as an example, we illustrate that issuing a capital structure amplifies any errors that are made evaluating the risk of the underlying securities. In particular, we show how modest imprecision in the parameter estimates can lead to variation in the default risk of the structured finance securities, which is sufficient, for example, to cause a security rated AAA to default with reasonable likelihood.

This securitization process (one with prioritized tranches as opposed to a pass-through securitization) substitutes risks that are largely diversifiable for risks that are highly systematic. As a result, senior tranches produced by structured finance activities have far less chance of surviving a severe economic downturn than traditional corporate securities of equal rating. And because the default risk of senior tranches is concentrated in systematically adverse economic states, investors should demand far larger risk premia for holding structured claims than for holding comparably rated corporate bonds.

We argue that both of these features of structured finance products — the extreme fragility of their ratings to modest imprecision in evaluating underlying risks and their severe exposure to systematic risks — go a long way in explaining the spectacular rise and fall of structured finance. In particular, both features gave rise to products that investors viewed to be safer than the underlying assets and were priced accordingly. At the core of the recent financial market crisis was the discovery that these securities were actually far riskier than originally advertised.

CoVaR

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In this paper, CoVaR is defined as the value-at-risk (VaR) of financial institutions conditional on other institutions being in distress. The increase of CoVaR relative to VaR measures spillover risk among institutions.

We estimate CoVaR using quantile regressions and document significant CoVaR increases among financial institutions. We identify six risk factors that allow institutions to offload tail risk and show that such hedging reduces the wedge between CoVaR and VaR.

We also argue that financial institutions should report CoVaR in addition to VaR, and we draw implications for risk management, regulation and systemic risk. We define co-expected shortfall as a sum of CoVaRs.

Derivatives Clearing and Systemic Risk

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In the current financial crisis, clearinghouses are often seen as a panacea for over-the-counter (OTC) derivatives products. For instance, trading in credit default and variance swaps



appear ready to migrate to centralized trading platforms, such as the Chicago Mercantile Exchange, EUREX, or Euronext-LIFFE. On the one hand, a clearinghouse greatly reduces default-risk concerns, as it systematically becomes the legal counterparty to each transaction undertaken on the exchange. On the other hand, a clearinghouse concentrates an increasing amount of risk, raising substantial systemic risk concerns.

Failure of a clearinghouse would trigger a cascade of damaging disruptions through the financial system. Yet little is known about the actual likelihood of such an event. Using daily data on initial and variation margins for all clearing members (typically brokerdealers and futures commission merchants) of the Chicago Mercantile Exchange's clearinghouse, we empirically analyze clearinghouse exposure to risk of default by members. The Chicago Mercantile Exchange is the largest and most diverse exchange in the world for trading futures and options - mainly on interest rates, equity indices, exchange rates and commodities.

This study is the first to analyze clearing member default risk using actual daily margin data. We conduct in-depth statistical analysis of the daily margins and profit and loss for both proprietary trading and trading by customers during the period 1999-2001.

During this sample period, we identify 68 occurrences when the daily loss in the house account exceeds the posted margin. Almost one-third of the clearing members have experienced a margin-exceeding loss. In one case, the loss was as high as 173% of the posted margin. We also find that margin-exceeding losses are much less frequent on the customer side, with only four occurrences in total. Our first conclusion is that the major source of default risk is proprietary trading and not trading by customers.

In this paper, we not only quantify default risk, but also show how this risk can be hedged through the purchase of default insurance. We design, and price, a realistic insurance contract covering loss to the clearinghouse from default by one or several clearing members. The insurance policy is based on cumulative default losses, subject to both a deductible and an overall payout limit.

Interestingly, there is a clear analogy between the premium for such default insurance and the fair cost of the implicit guarantee provided by a central bank or other government agency. Indeed, just like an insurance company, the Federal Reserve might have to compensate the clearinghouse in the event of default by one or several clearing members to prevent clearinghouse failure and breakdown of the financial system.

As a result, our study permits one to assign a dollar cost to this service provided by the central bank, in its role as implicit insurer of the clearinghouse. This is ultimately the cost to the taxpayer of such implicit protection. We estimate that this cost could be as high as \$3 million for three-year coverage.

Information about the empirical performance of a clearing institution — whether a public exchange or a private derivatives product corporation — is likely to be of interest to the entire financial risk-management community.

Key factors explaining the extraordinary ability of clearinghouses to survive periods of intense market stress include their limited number of clearing members with stringent capital adequacy requirements; strict segregation between proprietary and customer trading; daily mark-to-market strategies; and scenario-based margin calculation.

Endogenous Systemic Liquidity Risk

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Gerhard Illing, Faculty of Economics, University of Munich, CESifo (Center for Economic Studies and Ifo Institute for Economic Research) illing@Imu.de http://ssrn.com/abstract=1191722 In 2004, the financial markets were awash with excessive liquidity. Subsequently, in August 2007, liquidity suddenly dried out, nearly completely, as a response to doubts about the quality of subprime mortgage-backed securities. Despite massive central bank interventions, the liquidity freeze did not melt away, but rather spread slowly to other markets.

Traditionally, aggregate liquidity shocks have been modelled as exogenous events. In this paper, we derive the aggregate share of liquid projects endogenously. It depends on the incentives of financial intermediaries to invest in risky, illiquid projects. This endogeneity allows us to capture the feedback between financial-market regulation and incentives of private banks, determining the aggregate amount of available liquidity.

We model (real) illiquidity in the following way: liquid projects are realized early. Illiquid projects promise a higher return, but a stochastic fraction of these types of projects will be realized late. We concentrate on pure illiquidity risk: There will be no insolvency unless triggered by illiquidity (by a bank run). Financial intermediaries choose the share invested in high vielding but less liquid assets. As a consequence of limited liability, banks are encouraged to free-ride on liquidity provision. Relying on sufficient liquidity provided by the market, banks are inclined to invest excessively in illiquid long-term projects.

Liquidity provision by central banks can help to prevent bank runs with inefficient early liquidation. In Cao & Illing (2007), we showed that the anticipation of unconditional liquidity provision results in overinvestment in risky activities (moral hazard), creating excessive systemic risk.

Extending our previous work, this paper analyzes the adequate policy response to endogenous systemic liquidity risk and provides a costbenefit analysis of different forms of banking regulation. This, in turn, enables a better understanding of what type of intervention is required. We explicitly compare the impact both of liquidity and capital requirements, and we show that it is crucial for an efficient lender-of-last-resort policy to impose ex ante minimum liquidity standards for banks.

In addition, we analyze the impact of equity requirements and narrow banking in the following sense: banks are required to hold sufficient liquid funds so as to pay out in all contingencies. We prove that such a policy is strictly inferior to imposing minimum-liquidity standards ex ante combined with lender-of-last-resort policy. It is even likely to be inferior relative to the outcome of a mixedstrategy equilibrium with free-riding banks.

In our model, with just two feasible aggregate states, narrow banking is equivalent to imposing equity requirements. The only role for equity here is to provide a cushion to protect against a poor economy. In a realistic setting with a continuous probability distribution, narrow banking would boil down to requiring sufficient equity even for the worst case, whereas equity requirements allow more flexibility. We leave it for future research to analyze that issue. Following the methodology proposed by Diamond & Rajan (2006), we model financial intermediation via traditional banks offering fragile deposit contracts. Systemic risk is triggered by bank runs.

In modern economies, a significant part of intermediation is provided by the shadow banking sector. These institutions (like hedge funds and investment banks) are not financed via deposits. However, they are highly leveraged. Incentives to "dance" (or to free-ride on liquidity provisions) seem to be even stronger for the shadow banking industry. So imposing liquidity requirements only for the banking sector will not be sufficient to cope with free-riding. In future work, we plan to analyze incentives for leveraged institutions within our framework.