What’s the chance of everything going wrong at the same time in your credit portfolio? That’s really the question that keeps bankers—and their regulators—awake at night.

BY JONATHAN YORK
Credit concentrations are behind most of the major banking disasters in history,¹ and they also explain today’s concerns about the level of commercial real estate lending in U.S. banks.

Until recently, however, borrower correlation and concentration risks have been difficult for the banking industry to measure in an objective way. Even the recent Basel II reforms largely dodged the measurement issue by shunting correlation risk into Pillar 2 (supervisory review) rather than Pillar 1 (minimum capital requirements).

As a result, bank efforts to manage concentration risk² are often based around broad-brush notional limits on particular names and sectors that fail to:
• Make a quantitative link to the correlations driving risk in each segment and may therefore fail to prevent concentrations from accumulating.
• Capture the multidimensional, enterprise-wide threat from concentration risk.
• Put dollar costs against concentration risks to promote rational decision making in this tricky area of risk management.

Risk management aside, broad-brush limits are bad for business because they restrict bank expansion in growth sectors where there may be no real economic reason for restraint.

This is particularly unfortunate for midsized regional and smaller banks that lack the enormous risk diversification benefits of the large banks and need to leverage their specialist skills in particular lending niches, including commercial real estate lending, if they are to compete.

So how can banks better understand the power of name and sectoral credit concentration risks, and learn to manage them in a transparent, rational way that maximizes risk-adjusted returns (and that reassures regulators)?

The power of concentration

The destructive power of credit concentrations depends on the degree of correlation among borrowers under various economic conditions. Correlations often only become apparent when economic conditions turn sour, which is why concentrations are a particularly hot topic now as interest rates rise and property values soften.

We can see the effect of different degrees of correlation in Figure 1, which models the loss rates over time in two illustrative bank portfolios. The portfolios are exactly the same in terms of the transaction-level risk factors that drive expected loss (e.g., borrower probability of default), but the customers in one portfolio have a particularly strong correlation with one another.

Both portfolios lose the same amount of money through credit loss, but the losses are spread out over time in different ways. Most of the time, the bank with high correlations (light blue line) looks like it is losing less money than its competitor—and the underwriters at this bank might think they are doing a particularly good job.

But that’s only because when times are good (or bad) for some borrowers, they tend to be good (or bad) for most borrowers. In effect, correlation is “storing up” losses to create a huge peak later on in the trough of the economic cycle.

Over time, this peak in losses makes the correlated portfolio look like the so-called bad dog of the pair, but whether this is so depends on the level of return the portfolio commands and the risk management skills of the bank’s executives.

Banks with heavy correlation risks can make money and steer clear of trouble, so long as they hold enough risk capital to protect the bank against the higher level of unexpected losses and charge their customers accordingly (or exit markets where market pricing makes charging for concentration risks impossible).

Where these skills are lacking, banks with strongly correlated portfolios suffer the double blow of heavy losses followed by the need to adjust ongoing business strategy (at a time when their credibility is low with investors and those charged with oversight). That is, if the bank manages to remain solvent!

Our next two figures highlight the special importance
of smaller, CRE-dominated banks improving risk-and-capital analytics with regard to concentration risk. Figure 2 shows the results of an economic capital analysis for a typical illustrative bank with three main portfolios: CRE, C&I, and consumer. We can see how the risk capital required by the bank rises sharply as the proportion of CRE lending creeps above 30% of the bank's portfolio, even though the gross lending amount and all the other risk factors (e.g., borrower rating, collateralization, and maturity) are held constant.

The driving forces here are the geographic and CRE sector concentrations in the bank's portfolio.

Figure 3 shows how a lumpy portfolio, where single-name exposures are large in comparison to the overall size of the bank's portfolio, drives up risk. We can see that economic capital increases as the size of the loans in the sample portfolio increases from less than $10 million to $400 million—all other risk factors kept equal—and that the effect is much more pronounced for a bank with $30 billion in assets than for a bank with $100 billion in assets.

These figures underline an important issue for maintaining capital adequacy: Correlations and concentrations drive the results of economic capital/credit portfolio modeling more than any other risk parameter.

### Measuring correlation

As this suggests, the best way to measure the risk of a concentrated portfolio is to join the dots between the more volatile loss distribution of correlated portfolios and their increased capital requirements, by means of a portfolio credit risk model. Economic capital concepts can then be used to put dollar costs against the concentration risk.

Until recently it was not easy to do this because, to implement such a model, banks first had to define and describe segments of similar risks and then estimate correlation parameters for each segment.

Describing portfolio segments is straightforward but critical to the usefulness of the analysis. For example, CRE segments should be described using Metropolitan Statistical Area (MSA) and property type, as both dimensions drive risk (Figure 4).

The real challenge, however, is finding a robust, defensible way to estimate the correlation parameters for each subportfolio. It is rarely practical to estimate default correlations directly from bank history of individual defaults—the data within each bank is too scarce to support the analysis.

Over the last few years, the banking industry has invested massively in developing ways to infer correlations from aggregate loss histories (including internal data) and from external market data.

There are various techniques according to the asset class—Figure 5 offers a starting point only—but, in many cases, the techniques depend conceptually on the Merton model, developed by Nobel laureate Robert Merton. This requires that certain assumptions be made to allow correlation to be estimated from observable data series, such as equity prices.

Analysts can also look at foreclosure and regional bankruptcy data. For example, BancWare ERisk's...
researchers have analyzed an extensive database of residential mortgage foreclosures by state, containing data from 1979 through 2004, to estimate correlation factors that can be incorporated into retail economic capital models.

As another example, BancWare ERisk has compiled a set of correlation analyses for banks focused on lending to agricultural and food-producing industries, based on analysis of state-level commodity cash receipts going back many decades.

Banks that try to estimate correlation numbers should take care to tailor their approach to the nature of their portfolios. For example, it can be problematic to parameterize correlations for small businesses using equity market data that, in reality, describes much larger corporations. Instead, it is better to estimate correlations by looking at the portfolio’s history of loss volatility.

There are also difficult choices to be made over the length of period from which the data is drawn: too short and it will not reflect a full economic cycle; too long and it may capture now-irrelevant changes in market structure.

Banks must also make sure they capture any correlations between risk factors that might worsen loss volatilities. Figure 6 shows how the correlation between CRE default and loss given default rates creates the potential for significantly greater loss volatilities. For example, banks lost a greater percentage of each loan in 1994, when default rates were also high, than in 2000, when both default and loss rates were low.

Correlation parameters should also be sense-checked by the bank’s most experienced underwriters and business leaders. Are the riskiest areas, in their experience, being accorded the highest correlation estimates?

Despite these difficulties, it is now practical for banks to put robust numbers against the correlations driving concentration risk in their portfolios. Soon, putting a number against correlations won’t seem much more unusual than putting a number against expected loss through credit scoring and rating.

This, in turn, means that banks can use fully specified economic capital models to calculate economic capital amounts for portfolios that take account of concentration risks. It’s then an easy matter to isolate the amount of economic capital attributable to the concentration risk itself.

The bank does this by running the full model, including the correlation parameters set to the bank’s estimates, and then comparing the results of this analysis to the results from the full model run with all correlation parameters (or selected parameters) set to zero. The difference between the numbers is the capital cost of the bank’s concentration risks (or any given correlation risk).

Putting concentration risk measurement to use: limits setting and deal selection

Figure 7 shows how we can begin to apply economic capital results to improve an institution’s concentration limits.

At the top of the house, economic capital gives a clear answer to the most pressing question of all: Does our capital (available capital) equal or exceed the capital necessary to ensure our survival (economic capital) with a given level of confidence (the bank’s solvency target) after taking account of our concentration risks?

At the subportfolio level, the bank will want to establish some basic hard limits to make sure it does not become too concentrated in particular lending types. Usu-
ally limits are placed on notional exposure such that the economic capital as a percentage of exposure does not exceed a certain threshold. For example, bank exposure to the subportfolio should not exceed 10–15% of the bank’s total portfolio exposure.

For each of the subportfolios, the bank can establish a hard rule based on economic capital. For example, the bank might decree that the average economic capital for the subportfolio should not exceed 8%. This allows the business manager to make some relatively risky deals that are profitable on a risk-adjusted basis, but ensures that the portfolio as a whole fits within the bank’s risk profile.

Because economic capital risk parameters take account of the cycle sensitivity of different industry sectors, lending to sectors that are very cyclical will tend to attract more economic capital and will therefore be limited more sharply than when lending to sectors with low cycle sensitivity.

Within the subportfolios, economic capital can be used to establish soft rules and risk flags that steer deal-making in the right direction. Here, we are most interested in how each incremental deal creates additional concentration risk.

To begin with, deals in new business segments won’t add any concentration risk at all, but as the business begins to make more and more deals of a similar nature, and these become a sizable proportion of the bank’s business, the incremental risk of each deal will begin to rise.

This suggests that a soft rule should be established. For example, the manager might be told that deals should not generally require more than 8% economic capital. A deal that commands 10% economic capital can be executed if it is very profitable or important to a relationship, but it will attract a yellow flag as an exception to the 8% rule.

The yellow flag will warn executives further up the bank hierarchy that concentration risks are piling up in the subportfolio. Soon, the bank may have to stop doing similar deals, or the average economic capital in the subportfolio will break the hard 8% subportfolio limit.

Rather than halting deals, banks might buy credit protection for large corporate “relationship” customers in the yellow-flag zone. For less critical customers, the bank might price each yellow-flag deal in line with rising concentration risk capital costs, gradually pricing itself out of the market (Figure 8).

The point of this approach is that, at both the subportfolio and transaction levels, business expansion will be limited only when this expansion becomes economically damaging to the bank (due to concentration risk costs).

**Conclusion**

Concentration risk in all its forms is a challenge for banks, particularly as they struggle to develop meaningful enterprise risk management.

For too long concentration risk has been managed in an imprecise, judgmental way that has not optimized bank strategic decisions, nor led to a clear dialogue between banks and their regulators about each bank’s distinct risk profile.
This article suggests that the tools are now available to put this right. It argues that the best way to put a number on concentration risk is to estimate correlations in key portfolios, and then to measure how these will drive loss volatilities and the bank’s economic capital requirements. (Table 1 summarizes the key differences between traditional approaches and this modern approach.)

These measurements can then be used to improve fundamental bank risk management tools, including sectoral risk limits, and to ensure that the bank is adequately capitalized. They can also be used to optimize the bank’s strategies, not only with regard to deal pricing and selection, but also with regard to acquisitions and investments.

For example, the bank will be able to run “what-if” analyses to ascertain:

- Whether a new acquisition will exacerbate concentration risks to a worrying degree.
- The risk diversification benefits of acquiring portfolios of business outside its home territory or usual business niches.

Similarly, it will be able to stress-test its correlation assumptions to find out which assumptions might be the bank’s weakest link in capital adequacy calculations.

Once the bank has put dollar costs against its portfolio and transaction concentration costs, it can begin to compare these costs to the price of risk-mitigation tools such as credit derivatives (and some forms of loan sale and securitization). Where credit derivatives do not exist (e.g., CRE sector), banks may be able to use futures (e.g., on property prices) to mitigate concentration risk.

In effect, economic-capital-based analysis of concentration risk allows the bank to take an enterprise perspective on all sorts of risk/reward trade-offs, so that executives can begin to optimize their decisions in pursuit of long-term shareholder value.

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Notes
1 Credit concentrations caused nine of 13 major banking system crises around the world in the last century, according to a 2004 Basel Committee study.

2 For a more detailed view of bank practice in this area, see Basel Committee on Banking Supervision, Working Paper No. 15, Studies on Credit Risk Concentration, November 2006, p. 7.

3 Economic capital models require various input parameters aside from correlation, as described in “How to Get Started Specifying Inputs to Your Economic Capital Model,” The RMA Journal, February 2006.

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### Table 1

<table>
<thead>
<tr>
<th>Traditional Versus Modern Approaches to Credit Concentration Risks</th>
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<tbody>
<tr>
<td><strong>Traditional</strong></td>
</tr>
<tr>
<td>How is concentration risk defined?</td>
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<tr>
<td>How is it limited?</td>
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<tr>
<td>How is it actively managed?</td>
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<tr>
<td>Strategic implications?</td>
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### Figure 7

**The “pyramid” approach to concentration risk management**

- **Consolidated total risk**
  - **Subportfolio exposure risk (hard limit)**: Exposure not to exceed 10-15% of total portfolio exposure.
  - **Within subportfolios average subportfolio risk (hard limit)**: Subportfolio average economic capital not to exceed 8%.
  - **Transaction marginal risk (soft limit)**: Marginal transaction economic capital not to exceed 8%.

- **Measure or limit** Available capital must equal or exceed economic capital.
- **Rationale** Total risk not to exceed capital available to absorb losses.
  - “Don’t put all your eggs in one basket.”
  - “Don’t create baskets that are likely to break.”
  - “Yellow flag”: Ability to price for risk. Transactions exceeding soft limit signal future hard-limit breaches.

Source: SunGard

### Figure 8

**Marginal risk analysis: Identify new loans that attract over Y% capital to exposure**

<table>
<thead>
<tr>
<th>Subportfolio</th>
<th>Cap to Exp Ratio on Next Loan</th>
<th>Credit Spread Required</th>
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<tbody>
<tr>
<td></td>
<td>RR 1 (%) RR 2 (%) RR 3 (%) RR 4 (%) RR 5 (%)</td>
<td>RR 1 (%) RR 2 (%) RR 3 (%) RR 4 (%) RR 5 (%)</td>
</tr>
<tr>
<td>Professional Services</td>
<td>5.9 7.5 9.7 10.2 10.9</td>
<td>1.35 1.72 2.22 2.33 2.49</td>
</tr>
<tr>
<td>CRE–Retail</td>
<td>4.8 7.1 8.9 9.6 10.1</td>
<td>1.14 1.68 2.31 2.26 2.39</td>
</tr>
<tr>
<td>CRE–Industrial</td>
<td>4.5 6.7 8.7 9.7 9.7</td>
<td>1.09 1.62 2.30 2.24 2.34</td>
</tr>
<tr>
<td>Wholesale</td>
<td>4.0 5.9 8.3 8.9 9.4</td>
<td>1.00 1.47 2.07 2.22 2.34</td>
</tr>
<tr>
<td>Health Care</td>
<td>3.3 5.1 7.7 8.3 8.8</td>
<td>0.82 1.27 1.91 2.04 2.18</td>
</tr>
<tr>
<td>Transportation</td>
<td>3.0 4.8 7.5 8.0 8.5</td>
<td>0.75 1.20 1.87 1.99 2.12</td>
</tr>
<tr>
<td>Financial Services</td>
<td>2.7 4.3 7.4 7.8 8.3</td>
<td>0.67 1.07 1.64 1.94 2.06</td>
</tr>
</tbody>
</table>

Illustrative only

Source: SunGard.