

Commercial Real Estate Stress Testing

Stress testing of commercial real estate portfolios has become an even more important risk management tool, especially since interest rates have begun to rise. Also, bank regulatory agencies have sharpened their focus on the industry, particularly for those banks with substantial concentrations. This article examines the use of stress testing to manage the credit risk process.



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The Loan Portfolio Management section of the *Comptroller's Handbook of Loan Portfolio Management* (April 1998) states that in stress testing, a bank alters assumptions about one or more financial, structural, or economic variables to determine the potential effect on the performance of a loan, concentration, or portfolio segment. Stress

testing for credit risk can be conducted on individual groups of loans, concentrations, loans above certain dollar thresholds, or other portfolio segments. Examples of commercial loan collateral are retail real estate, warehouses, and office buildings.

A common use of stress testing is to subject various assets and liabilities to hypothetical scenarios to determine their exposure to changes in interest rates.

Table 1

Historical Data																
Loan Number	Loan Type	Date of Loan	Amount	Net Operating Income (NOI)	Date of NOI Info	Source of NOI Info	Appraised Value	Date of AV	Cap Rate From AV	Original LTV	Int. Rate Spread	Rate Index	Interest Rate	Annual P&I	Original DSC	9/30/2006 Loan Balance
101	1	3/25/2004	1,800,000	207,900	3/31/2006	Customer Update	2,575,000	2/20/2004	7.75%	70.00%	1.00%	Prime	7.75%	163,151	1.25x	1,705,047
102	2	5/20/2003	2,400,000	287,400	12/31/2005	Fed. Tax Return	3,300,000	4/15/2003	9.50%	72.70%	1.00%	Prime	7.75%	217,535	1.29x	2,274,506
103	3	9/30/2003	1,664,000	259,920	12/31/2005	Fed. Tax Return	2,736,000	6/20/2005	9.50%	60.00%	1.00%	Prime	7.75%	155,893	1.66x	1,121,876
104	4	2/10/2004	2,230,000	249,288	6/30/2005	Customer Update	2,750,000	1/27/2004	9.50%	81.00%	Fixed	Fixed	5.50%	164,330	1.35x	2,134,661

The bank then adjusts the base rates charged on its loans in accordance with changes to the base rate index as stated in the respective loan contracts.

Another use is to alter financial variables and assess the resulting impact. For example, altering office space rental rates or vacancy percentages affects the building's cash flow and capacity for debt-service repayment. By determining the rental rate at which a project could no longer service its indebtedness, the bank can prevent adverse consequences of unforeseen market changes.

Preparing for Stress Testing

Data. An adequate database of loan information is key to successful stress testing, and *it is critical that the data be appropriate, up-to-date, and accurate*—both during the initial underwriting and at new loan booking periods. Although a time-consuming process, data collection is essential; otherwise, loan files may have to be physically reviewed to extract the data needed to support the process.

Basic file information needed for stress testing includes such items as the original appraised value (including capitalization rate and date), projected income, original loan to value, and debt-service coverage for each loan to be tested. Updated operating income and current interest rate data

ensure even more meaningful results. Once compiled, the information should be validated and then updated—semiannually or using a time frame that coincides with the next scheduled stress-testing date.

It's up to management to decide which loans or loan groups need to be stressed. It's useful to establish a dollar threshold so that immaterial amounts or loans about to be paid off are not included in the analysis. The test portfolio usually includes loans for office, warehouse/industrial, hotel, and apartments, as well as properties held for investment or properties under construction that will be converted to mini-perm loans.

As shown in Table 1, required information includes, at minimum, the following:

- Loan number or name.
- Loan type.
- Date of loan.
- Original amount of loan.
- Net operating income (most recent available).
- Date of last information on net operating income.
- Source of operating information (appraisal/credit memo/actual).
- Appraised value.
- Date of appraisal.
- Capitalization rate from appraisal.
- Original loan to value.
- Interest rate spread.
- Basis of rate index.
- Current interest rate.
- Rate floor (if applicable).
- Rate ceiling (if applicable).
- Annual principal and interest payments.
- Original debt-service coverage.
- Current loan balance.

Figure 1

Stress Test #1—Increases in Interest Rates				
Mild Increase				
Loan Number	Amount of Increase	New Interest Rate	New Prin. & Int. Pmts.	New DSC after 1% Increase
101	1%	8.75%	\$180,201	1.15
102	1%	8.75%	\$240,280	1.20
103	1%	8.75%	\$167,112	1.56
104	Fixed	Fixed	\$164,330	1.52
Moderate Increase				
Amount of Increase	New Interest Rate	New Prin. & Int. Pmts.	New DSC after 2% Increase	
2%	9.75%	\$197,252	1.05	
2%	9.75%	\$263,025	1.09	
2%	9.75%	\$178,331	1.46	
Fixed	Fixed	\$164,330	1.52	
Severe Increase				
Amount of Increase	New Interest Rate	New Prin. & Int. Pmts	New DSC after 3% Increase	Account Officer Comments
3%	10.75%	\$214,302	0.97	Strong guarantor
3%	10.75%	\$285,770	1.01	
3%	10.75%	\$189,549	1.37	
Fixed	Fixed	\$164,330	1.52	

This information could be added to the loan trail using the format just listed if columns are available, but each new loan and all its data entries must be entered separately. In the alternative, the information can be compiled on a separate spreadsheet to facilitate the calculations for the stress tests using arithmetic formulas, which is how it's done in this article.

A review of the information usually discloses which capitalization rates are inaccurate and which loan-to-value percentages and debt-service-coverage ratios are questionable. It is easier to address this information before the start of the stress-testing cal-

culations, although some questions may arise as the calculations are completed. Follow-up on any suspect initial data must occur in this phase to ensure the integrity of computed data in subsequent computations.

The historical data provides the foundation for these stress-test segments. The formats for the various tables are coupled with a historical data sheet for each stress test.

Stress Tests 1-3: General Comments. Using Microsoft Excel® formulas, the loan data is expanded to include the effect of increases in interest rates, declines in net operating income

(NOI), and changes in capitalization (cap) rates.

- *NOI* can be defined as net income of a given project before depreciation and amortization, and it is a starting point to assess the ability of the project to repay its indebtedness. *NOI* also may include adequate reserves for repairs, tenant improvements, etc., that are characteristic of the particular projects being tested.
- Cap rates are the yields investors anticipate on comparable investments, applied to the *NOI* of the project.
- *NOI* divided by the cap rate calculates a value in the income approach used in the appraisal process.

These definitions are oversimplifications, but they provide some basic background for purposes of this discussion.

Management should decide the degree to which adjustments/changes are made to base data for stressing purposes, using decision factors and levels that are consistent with the trends noted in the bank's market. Outside factors also may be considered—for example, anticipated decisions relating to interest rate adjustments likely to be made by the Federal Reserve. Once these changes and adjustments to *NOI* and other factors are decided, revised debt-service coverage (*DSC*) and loan-to-value (*LTV*) ratios are calculated.

DSC is the annual net operating income divided by the required annual principal and interest payments expressed as a factor, with 1.00X being 100%. This rate can also show the lender the borrower's ability to sustain

Figure 2

Stress Test #2—Decline in Net Operating Income		
Mild Shock		
Loan Number	NOI Less 5%	New DSC with 5% Less NOI
101	\$197,505	1.21
102	\$273,030	1.26
103	\$246,924	1.58
104	236,824	1.44
Moderate Shock		
NOI Less 10%	New DSC with 10% Less NOI	
\$187,110	1.15	
\$258,660	1.19	
\$233,928	1.50	
\$224,359	1.37	
Severe Shock		
NOI Less 15%	New DSC with 15% Less NOI	
\$176,715	1.08	
\$244,290	1.12	
\$220,932	1.42	
\$211,895	1.29	

adverse events, such as declines in income, increases in rates, etc. *LTV* is the loan balance divided by the appraised or market value and expressed as a percentage. This percentage verifies the lender's investment or risk in the project compared to the borrower.

The Stress-Test Examples 1-3

#1: Increases in Interest Rates. The most basic stress test, as shown in Figure 1, is for interest rate increases. Usually, the base interest rate is increased by a realistic increment. Management must decide which increases would be appropriate for their respective institutions. Increases of 1%, then 2%, and then 3%

were used in this example. These rate shocks, as they correlate to the rate increases, could be labeled *mild*, *moderate*, and *severe*, respectively.

Input from individual loan account officers or additional credit-related information maintained in the credit files could be critical to the analysis process. For instance, mitigating comments by the account officer would address any outside factors not evident in the numeric calculation of the revised DSC. This might include strength of guarantors, liquidity of related companies or principals, expiring leases with anticipated increases in revised agreements, outside sources of income, and new tenants occupying the space. Loans that exhibit calculated weaknesses in the various testing process and that do not have some type of mitigating support will be of greater concern to management. Testing results may dictate that these credits receive greater attention in the lending institution's overall credit administration process.

An institution's loan policy usually establishes the minimally acceptable DSC. If the DSC ratio required in the loan policy is 1.25X for a specific type of loan, with all other credit variables remaining unchanged, interest rate increases would likely negatively impact the actual ratio. As loans fall below this coverage ratio, there would still be enough income to service the debt if the DSC were at 1.00X or higher. However, when the DSC falls *below* 1.00X, account officer comments or a review of the loan by a credit analyst or loan officer

Figure 3

Stress Test #3—Changes in Collateral Values		
Mild Stress		
Loan Number	NOI Applied to Historical CAP Rate	New LTV
101	\$2,682,581	63.56%
102	\$3,025,263	75.18%
103	\$2,736,00	41.00%
104	\$2,624,084	81.35%
Moderate Stress		
Cap Rate Plus 1%	NOI Applied to CAP Rate Plus 1%	New LTV
8.75%	\$2,376,000	71.76%
10.50%	\$2,737,143	83.10%
10.50%	\$2,475,429	45.32%
10.50%	\$2,374,171	89.91%
Severe Stress		
Cap Rate Plus 2%	NOI Applied to CAP Rate Plus 2%	New LTV
9.75%	\$2,132,308	79.96%
11.50%	\$2,499,130	91.01%
11.50%	\$2,260,174	49.64%
11.50%	\$2,167,722	98.48%

becomes more critical. The analysis may highlight additional repayment sources or credit strength of the principals or guarantors. These could be documented as mitigating circumstances in a separate document or abbreviated in the Excel spreadsheet under "account officer comments." Credit relationships with DSC below 1.00X and without mitigating information could be considered for the internal "watch" list or other appropriate credit-monitoring system.

Many institutions already address this issue in their credit authorizations and memorandums, forecasting the effect of a 1-or 2-percentage-point rate increase on

repayment coverage and, sometimes, calculating how far rates have to increase before the borrower reaches breakeven. In this schedule, it is obvious that loan #101 has some potential debt coverage problems. Follow-up with the respective loan officer revealed that the DSC was marginal going into the transaction (assuming a policy requirement of 1.25X or more), but the loan guarantor's financial position supports the credit through a strong net worth, liquidity, and so on, thus reducing management concerns about this specific test result. If there are a significant number of loans falling below 1.00X DSC with a 3% rate increase, the policy requirement of 1.25X may have to be reconsidered.

#2: Decline in Net Operating Income. Another method of stress testing is the effect on NOI generated by the commercial real estate property. Declines in rental rates or increasing vacancy percentages would adversely affect NOI. In Figure 2, NOI is shown with declines of 5%, 10%, and 15%. NOI would be adjusted for these changes and a new DSC calculated. The NOI shocks as they correlate to the NOI changes could be labeled *mild*, *moderate*, and *severe*, respectively.

A new DSC below 1.00X would indicate inadequate cash flow from the property to service the debt if the borrower experiences significant income declines. Account officers may address these issues from file information. Also, this would allow management to address issues that might be resolved by working with the borrower. Borrowers without sufficient

mitigating circumstances would be reviewed and could be subject to additional monitoring or a change in the loan grade.

Assuming a DSC requirement of 1.25X for these loan products, two credits (#101 and #102) fall below this requirement but still have DSC above 1.00X, providing marginal coverage (1.08X and 1.12X, respectively). If there are a significant number of these credits, they could be bundled into an internal "watch" or similar category to be monitored more closely if rental rates start falling.

#3: Changes in Collateral Values. Changes in interest rates and declining net operating income may also translate into a change in the collateral value. This schedule, as seen in Figure 3, first updates the present NOI to the historical cap rate as shown in the appraisal. If cap rates are significantly different, the rate may have to be adjusted to the current environment. Then the cap rates from the original appraisals or updates are adjusted upward by 1%, then 2%. New appraised values (AVs) are calculated and compared to the current balance for a new LTV percentage. Original loan data would provide the starting point, including the original appraised value and cap rate.

New LTVs in excess of 100% would not indicate an inability to repay, but they do highlight potential problems in collateral coverage. Higher LTVs result in a reduced level of equity in a particular collateral property, should collateral liquidation become necessary. Account officers may be in the best position to furnish additional information that may miti-

gate concerns over the potential for declines in property values.

Two loans (#102 and #104) are approaching the 100% LTV threshold in this test, but remain slightly below that level. Referring to the original information (Table 1, Historical Data), loan #102 had a 72.70% LTV, and loan #104 had an 81% LTV. If the policy required a 75% LTV, loan #104 may have been an exception to policy and has not been amortized at an amount sufficient to bring it into compliance with policy. The loan file and/or the account officer would be expected to address the relatively high LTV and potential mitigating circumstances, if any. The test results also show that in the case of these two particular loans, the collateral potentially provides little equity support to the lending institution in times of critical property-value depreciation.

Mild Shock, Moderate Shock, and Severe Shock Stress Tests

The three stress-test examples in this article are interrelated in the analysis of the commercial real estate portfolio. We now need to take this analysis a step further and *combine the results*, because these changes usually work together and have an influence on the DSC of a given project and its value.

We start with the basic file data, including the appraised value, NOI, DSC, LTV, and cap rate taken from the original appraisal maintained on file. The basic data has already been identified in Table 1 and calculated in Figures 1, 2, and 3. The historical data is then expanded to provide the data inputs for the Mild Shock, Moderate Shock, and Severe Shock stress tests that we

Table 2

Mild Shock								
Mild Interest Rate Increase <i>Increase of 1% in Interest Rates</i>					Mild NOI Adjustment <i>Decrease of 5% NOI Plus 1% Interest Increase</i>		Mild Change in Collateral Value <i>Decrease of 5% NOI Applied to Historical CAP Rate</i>	
Loan Number	Amount of Increase	New Int. Rate	New Prin & Int. Payment	New DSC with 1% Int. Increase	NOI Less 5%	New DSC	New NOI with Historical CAP Rate	New LTV
101	1.00%	8.75%	180,201	1.15	197,505	1.10	2,548,452	66.91%
102	1.00%	8.75%	240,280	1.20	273,030	1.14	2,874,000	79.14%
103	1.00%	8.75%	167,112	1.56	246,924	1.48	2,599,200	43.16%
104	Fixed	Fixed	164,330	1.52	236,824	1.44	2,492,884	85.63%

now are ready to discuss.

Mild shock summary. The mild shock shown in Table 2 summarizes the effects of a 1% increase in interest rates and a 5% drop in NOI, and it applies those effects to the cap rate found in the appraisal. The result is a revised DSC ratio and LTV percentage.

A DSC below 1.00X and a LTV above 100% will many times relate to the same loan, and these additional comments may be brought forward from Stress Tests 1-3, if appropriate.

With a calculated decline in value combined with potential DSC below 1.00X, the outside mitigating circumstances may need

to be stronger and/or the loan may require additional review.

The result of the mild shock on the four loan examples shows that the credits can withstand the three mild effects and retain adequate DSC to meet payment requirements and adequate LTV percentages to provide collateral protection. However, note that loans #101 and #102 fall under the 1.25X DSC policy requirement established by the lending institution but still remain above 1.00X coverage. Loan-to-value percentages demonstrate sufficient value, with #104 moving to over 85%. This is not surprising, given the 81% historical LTV.

Moderate shock summary.

The moderate shock shown in Table 3 summarizes the effects of a 2% increase in interest rates and a 10% decline in NOI, and then calculates the results with the historical cap rate and that rate increased by 1%. The resulting DSC and LTV ratios reflect these changes.

A DSC below 1.00X and an LTV above 100% will many times relate to the same loan, and these additional comments may be brought forward from Stress Tests 1-3. With a calculated decline in value combined with potential DSC below 1.00X, the outside mitigating circumstances may need to be stronger or the impacted loans may require additional reviews.

Table 3

Moderate Shock											
Moderate Interest Rate Increase <i>Increase of 2% in Interest Rates</i>					Moderate NOI Adjustment <i>Decrease of 10% NOI Plus 2% Interest Increase</i>		Moderate Change in Collateral Value <i>Decrease of 10% NOI Applied to CAP Rate Plus 1%</i>				
Loan Number	Amount of Increase	New Int. Rate	New Prin & Int. Payment	New DSC with 1% Int. Increase	NOI Less 10%	New DSC	NOI Less 10% Applied to Historical Cap Rate	Cap Rate Plus 1%	New NOI with CAP Rate Plus 1%	New LTV	Account Officer Comments
101	2.00%	9.75%	197,252	1.05	187,110	0.95	2,414,323	8.75%	2,138,400	79.74%	Strong guarantor
102	2.00%	9.75%	263,025	1.09	258,660	0.98	2,722,737	10.50%	2,463,429	92.33%	Guarantor has liquidity
103	2.00%	9.75%	178,331	1.46	233,928	1.31	2,462,400	10.50%	2,227,886	50.36%	
104	Fixed	Fixed	164,330	1.52	224,359	1.37	2,361,674	10.50%	2,136,752	99.90%	

Table 4

Severe Shock											
Severe Interest Rate Adjustment <i>Increase of 3%</i>					Severe NOI Adjustment <i>Decrease of 15% NOI Plus 3.00% Rate Increase</i>		Severe Change in Collateral Value <i>Decrease of 15% NOI Applied to CAP Rate Plus 2%</i>				
Loan Number	Amount of Increase	New Int. Rate	New Prin & Int. Payment	New DSC with 3% Int. Increase	NOI Less 15%	New DSC	NOI Less 15% Applied to Historical Cap Rate	Cap Rate Plus 2%	New NOI with CAP Rate Plus 2%	New LTV	Adjusted AV Less Current Loan Balance
101	3.00%	10.75%	214,302	0.97	176,715	0.82	2,280,194	9.75%	1,812,462	94.07%	
102	3.00%	10.75%	285,770	1.01	244,290	0.85	2,571,474	11.50%	2,124,261	107.07%	(150,245)
103	3.00%	10.75%	189,549	1.37	220,932	1.17	2,325,600	11.50%	1,921,148	58.40%	
104	Fixed	Fixed	164,330	1.52	211,895	1.29	2,230,472	11.50%	1,842,565	115.85%	(292,096)
							Potential Exposure				(442,341)

With a 2% interest rate increase and NOI declining by 10%, DSC ratios on #101 and #102 fall below 1.00X. While both have strong guarantors with sufficient liquidity, the LTV on #102 moves to above 90%. Loan #104 is near 100% LTV but still has sufficient DSC at 1.37x, aided by its fixed interest rate.

Severe shock summary. The severe shock shown in Table 4 summarizes the effects of a 3% increase in interest rates and a 15% decline in NOI, and then calculates the results applied to the historical cap rate plus 2%. The resulting DSC and LTV ratios reflect these changes.

The calculation for adjusted AV less current loan balance represents the amount of potential exposure in the commercial real estate portfolio with the effects of the severe stress tests. This column can be accumulated and 1) compared to the bank's capital accounts, 2) included in the calculation of the allowance for loan and lease losses (ALLL), and 3) used in the review of credit

administration policies, including concentration limits as subsequently discussed.

With a 3% interest rate increase and 15% decline in NOI, the DSCs for loans #101 and #102 fall to 0.82X and 0.85X, respectively. While strong guarantors are mitigating factors, their overall financial situation and liquidity may have to be addressed in the file or in subsequent transactions. With the decline in NOI and increase in the cap rate, loans #102 and #104 have potential exposure totaling \$442,341. While not a material item in itself, if the potential exposure in the entire portfolio is material, management may want to reconsider DSC ratios and LTV percentages currently specified in the loan policy. The total effect on the commercial income-producing property portfolio could also be shown under the narrative factors in the ALLL as possibly requiring an additional 0.25% to 0.50% incremental margin to address the potential exposure.

Analysis of potential decline

in appraised value. Another method of reviewing commercial real estate values for stress testing would be to take the appraised value of the project and observe the effects of declines in value, as shown in Table 5. Declines of 10%, 15%, 25%, and 35%, for example, could be applied to the original appraised values of properties serving as collateral for loans being tested. Adjusted LTVs could then be calculated. We would also supply the Excel sheet with the historical data and the data inputs to test for declines in appraised value.

Most loan policies require a regulatory lending margin (15-25%) in the property for the original granting of the loan, so few exposures in the adjusted values appear until the decline in property value reaches 25-35%. Exceptions might include non-real-estate additional collateral or workout loans. There could be other circumstances: For example, some credits could have long lease-up periods or unfinished tenant improvements that might provide some mitigation. This

Table 5

AV Decline												
Loan Number	10% Decline in Property Value	10% Decline: Adjusted LTV	AV Adjusted 10% Less Principal Balance	15% Decline in Property Value	15% Decline in Adjusted LTV	AV Adjusted 15% Less Principal Balance	25% Decline in Property Value	25% Decline in Adjusted LTV	AV Adjusted 25% Less Principal Balance	35% Decline in Property Value	35% Decline in Adjusted LTV	AV Adjusted 35% Less Principal Balance
101	2,317,500	73.57%		2,188,750	77.90%		1,931,250	88.29%		1,673,750	101.87%	(31,297)
102	2,970,000	76.58%		2,805,000	81.09%		2,475,000	91.90%		22,145,000	106.04%	(129,506)
103	2,462,400	45.56%		2,325,600	48.24%		2,052,000	54.67%		1,778,400	63.08%	
104	2,475,000	86.25%		2,337,500	91.32%		2,062,500	103.50%	(72,161)	1,787,500	119.42%	(347,161)
							Potential Exposure	(72,161)				(507,964)

exposure can be summarized and related to capital accounts and the ALLL. In reality, a potential decline is not a default, and commercial properties are like other assets held by investors/owners that fluctuate over time through value increases and declines. The summary of the potential declines represents another view of the portfolio and analysis of the institution's exposure.

The effects of declines in AV are not material in the first two decline scenarios. A decline of 10% or 15% has no effect due to the policy requirements on the LTVs of the loans at origination. The effects start materializing at the 25% decline on loan #104 due to its historical (original) LTV, which was 81%. Other loans remain below 100% LTV, although #102 exceeds 90%. At a 35% decline, loans #101 and #102 also exceed 100% LTV, but the potential exposure is limited. Another factor in this analysis may be whether a credit is relatively new and has not had much amortization. Loan #104 has more potential exposure, due to its historical LTV. Management may want to reconsider the LTV policy

requirements or redefine the parameters of an acceptable exception to policy, depending on the volume of loans with LTVs exceeding 100%.

If the real estate market deteriorated to this "severe stress" level, the exposure in these loans might have to be recognized by augmentation of capital accounts and/or additional allocations to the ALLL. If foreclosures or reappraisal of nonaccrual loans and other problematic loans produced a significant decline in appraised values, those losses would likely have to be charged to earnings or capital accounts.

Analyzing the Effect of Declines in Real Estate Development Lots or Construction Loans

Land, lots, and construction loans: Analysis of potential decline in value. A schedule can be constructed of funded construction loan commitments divided into various categories, including residential lots, single-family residential homes, land, and retail buildings. Table 6 provides an example.

The amounts can be tested for declines in value and the

effects on the institution's capital accounts. For example, using a 75% LTV guideline from the loan policy, the construction loans are assumed to be conforming to this LTV policy. The construction loan segment could be subjected to potential declines in value beginning with 35%. We can assume that it would take more than a 25% decline in the market value of the collateral before there would be an effect, which would be only the difference between 25% and 35%, i.e., 10%. This potential decline in the construction loan portfolio can be applied to the institution's capital accounts to measure the impact on a large construction portfolio if the market value adjusts downward.

- A 35% decline would have a potential decline based on the stated policy LTVs of the committed amounts.
 - A 40% decline would have a potential decline and a resulting lower capital ratio after deducting potential exposure.
 - A 50% decline would reveal additional potential exposure deducted from capital accounts.
- A decline in value would be

Table 6

Land, Lots, and Construction Analysis of Potential Decline in Value (in 000s)

Description	9/30/2006 Committed	LTV Guideline	35% Decline	40% Decline	50% Decline
Residential Lots	\$40,000	75%	\$4,000	\$6,000	\$10,000
SFRs	30,000	75%	3,000	4,500	7,500
Undeveloped Land	40,000	75%	4,000	6,000	10,000
Retail Construction	30,000	75%	3,000	4,500	7,500
Office Construction	10,000	75%	1,000	1,500	2,500
Totals	\$150,000		\$15,000	\$22,500	\$37,500
Tier 1 Capital	\$35,000		\$20,000	\$12,500	(\$2,500)
Adjusted Capital Ratio	8.75%		5.20%	3.31%	Negative
Additional Capital Required for Restoration of 8% Tier 1 Capital			\$10,800	\$17,700	\$31,500

amplified by the volume of such committed amounts in each category. The results of this analysis would have to be considered in future management decisions, understanding that it is unlikely that all categories of construction loans in all locations would decline in tandem.

While these adjustments seem severe, this accentuates the need to understand risk and the level that board of directors will tolerate. If the bank is concentrated in undeveloped lots or another category, management may feel that this concentration should be reduced or offset by other unrelated asset investments to better diversify the portfolio.

Correlation of real estate portfolio sectors. While speculative construction would obviously hold the most risk in a market downturn, all sectors of the real estate market would likely experience some adjustment. For this reason, stress testing is used on all market segments.

Most closely allied would be speculative lot development loans for residential real estate with the

speculative building of single-family residences (SFRs). A slowdown in speculative SFRs will impact undeveloped or partially developed SFR lot inventory.

Another area would be speculative commercial real estate lot development. Any downturn in the office, retail, warehouse, and related markets would affect the partially developed or finished lot inventory for speculative commercial properties.

Management could calculate concentrations of speculative and pre-sold SFRs and speculative SFR lot inventory for a more realistic assessment of this risk.

Stress Testing Income on Total Loans

Analysis of decline in interest income/increase in loan loss provisions: total loans. As seen in Table 7, several scenarios can be compiled for the possibility of a decline in interest income from the downturn in all loan sectors, along with a comparable percentage increase in the provision for loan losses in the income statement. For example, the financial information at the end of a quarter

can be adjusted for a 10% decline in interest income coupled with a 10% increase in the loan loss provision. This would incorporate a decline in the overall portfolio, not just the CRE portion. Total loan income could be reduced by 15%, along with an increase in loan loss provisions of 15%. Additionally, a 25% reduction of total loan income would be coupled with an increase in loan loss provisions.

A substantial increase in problem assets would increase other expenses that follow these events (e.g., legal expenses, collections costs, etc.). However, this is generally manageable without a large increase in other expenses in the short term. The detrimental effects on net income will be evident from the analysis of this example, which highlights the effects of a substantial economic decline in all loan areas.

The 10% decline in NII and other effects leave this example with positive income, although substantially decreased. A 15% decrease in NII and increase in LLP result in a small loss, increas-

Table 7

Decline in Net Interest Income and Increase in Loan Loss Provisions in (000s)

Account	YTD Through 9/30/2006	Mild Decline	Moderate Decline	Severe Decline
		10% Decline NII 10% Increase LLP	15% Decline NII 15% Increase LLP	25% Decline NII 25% Increase LLP
Total Interest Income	\$20,000	\$18,000	\$17,000	\$15,000
Total Interest Expense	(10,000)	(10,000)	(10,000)	(10,000)
Loan Loss Provision	(1,000)	(1,100)	(1,150)	(1,250)
Noninterest income	2,000	2,000	2,000	2,000
Noninterest expense	(6,000)	(6,000)	(6,000)	(6,000)
Provision Income Tax	(3,000)	(2,700)	(2,550)	(2,250)
Net Income	\$2,000	\$200	(\$700)	(\$2,250)

ing with the 25% decline in NII and 25% increase in LLP with other minor adjustments.

Other Regulatory Considerations

References have been made throughout this article to situations where several of the stress tests have resulted in the potential need to revisit certain credits from a credit risk perspective. This may involve cases where extensive increased risks revealed by stresses raise concerns about the overall credit quality of such loans. Management then must ensure that the bank has made adequate provisions in the ALLL for such potential credit weaknesses.

Internal loan grading and ALLL. Prudent banking entails the development and implementation of a formal program for identifying problem loans and/or those exhibiting the potential to become problems. Banking regulatory agencies expect financial institutions to establish their own respective internal risk management program that will incorporate, at minimum, a risk-rating process. In support of this program, banks normally adopt a formal internal loan grading/rating

system to identify the degree of problems evident in the loan portfolio. As various influences come into play—in this case, external events created by adverse developments resulting from a variety of causes (interest rate increases, declines in property values, etc.)—banks must reassess the degree of protection accorded by the borrowers' and guarantors' ability to repay and protection provided by equity in collateral properties.

The results of the various stress tests presented in this article can be incorporated into the risk management program as an additional tool for identifying potential problems that may develop in the portfolio. Stress tests may show exceptions arising from situations where projected changes will result in depressed LTVs (representing lower or lack of equity position) and lower DSCs (indicating possible issues with regard to the borrower's ability to repay). In these instances, credit officials must determine what the appropriate response will be to these noted exceptions. The stress-testing process itself provides one initial measure to be

taken—that is, to follow up with the appropriate credit officers to determine if any mitigations are evident (strong guarantors, additional non-real-estate collateral, etc). If not, then the next step would be to decide if a given exception needs to be assigned a reduced credit grade (as defined within that given bank's internal credit risk identification program) or otherwise listed for "watch/track closely" status. In the latter scenario, further consideration would be accorded these credits during the ALLL review period, as subsequently addressed, which should occur on at least a quarterly basis.

Additionally, there must be a process to provide needed provision expense contributions to the bank's ALLL account to cover anticipated loan losses and to provide a general reserve to support risk identified in the remaining loan portfolio. Financial institution directors must certify the adequacy of the ALLL when filing their reports of income/condition with their respective agencies. In situations where adverse trends are noted (such as depressed real estate markets,

which ultimately adversely affect a bank's level of equity protection or a borrower's ability to generate sufficient cash flow for use in repaying obligations) and there are no mitigating circumstances identified, potential exists for repayment problems. As mentioned, there is potential for a lower loan grade or an adverse classification of the loan in cases of inadequate DSC and no mitigating circumstances, especially if the borrower becomes past due or has financial problems in other projects. These changes would also have to be considered in the analysis of the bank's quarterly review of the ALLL. Additionally, the presence of large concentrations in any given loan category, especially in commercial real estate portfolios, must be factored into the analytical process.

Effect on earnings. In cases where increased reserve allocations must be provided to the ALLL, operating earnings will be impacted because loan loss provisions represent an expense item; ultimately, equity capital will be affected as a result of the loss of retained earnings used to fund the increased reserve. As loan problems—or the likelihood of loan problems—increase, the bank may need to add additional equity support (by augmenting capital). Each bank regulatory agency has developed its own set of regulatory standards with regard to capital adequacy. Bank management should coordinate with its respective agency should the need for capital augmentation ever appear necessary.

Loan concentrations. Loan concentrations result in cases where a significantly large volume

of economically related assets (in this case, real estate loans) in common have been advanced or committed. In general, loans in the same specific economic categories/types representing in excess of 100% of total equity capital would constitute a concentration. Credit administration practices and procedures are of primary importance when assessing stress testing and are addressed in various regulatory publications. The *Joint Regulatory Agency Proposed Guidance on Commercial Real Estate Lending*, dated January 10, 2006, mentions a number of considerations:

- Underwriting procedures should be formalized and specific, with policy exceptions tracked.
- Loan concentrations should be realistic and periodically evaluated in view of market conditions.
- Studies of market conditions should be presented periodically to the loan committee or board of directors. These studies should address markets where the loan concentrations or loan products predominate.
- Loan officers should have adequate experience in their areas of responsibility.
- More complex appraisals should be adequately reviewed, and the review should be documented.
- Values cited in appraisals should be monitored and periodically reported to the loan committee, especially if they reflect material changes in pricing.
- Managements should be aware of their representation in the market. Is the bank

financing the majority of commercial real estate for a particular segment, such as warehouses or office buildings?

The bank's internal concentration is monitored by concentration limits, and it is helpful to note the level of risk in the external market.

- The analysis of the ALLL should adequately address concentrations and other factors, including the condition of real estate markets in which the institution lends.

Summary

By using the tests and considering the issues presented in this article, management should have an overall idea about any potential exposure in the portfolio and may want to address policies regarding future credit decisions. In addition, the need for further review or monitoring of certain relationships will be evident from the stress-testing process. The impact of the allocation on the ALLL may need to be considered and additional amounts allocated. □

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