## Notes on Bank Balance Sheets

### Table 12.3
Risks Banks Face and How They Manage Them

<table>
<thead>
<tr>
<th>Type of Risk</th>
<th>Source of Risk</th>
<th>Recommended Responses</th>
</tr>
</thead>
</table>
| Liquidity Risk     | Sudden withdrawals by depositors or takedowns of credit lines                   | 1. Hold sufficient cash reserves to meet customer demand.  
2. Manage assets—sell securities or loans (contracts the size of the balance sheet)  
3. Manage liabilities—attract more deposits (maintains the size of the balance sheet) |
| Credit Risk        | Default by borrowers on their loans                                           | 1. Diversify to spread risk.  
2. Use statistical models to screen for creditworthy borrowers.  
3. Monitor to reduce moral hazard. |
| Interest-Rate Risk | Mismatch in maturity of assets and liabilities coupled with a change in interest rates | 1. Closely match the maturity of both sides of the balance sheet.  
2. Use derivatives such as interest-rate swaps. |
| Trading (Market) Risk | Trading losses in the bank’s own account                                      | Closely monitor traders using risk management tools, including value at risk.                                                                    |

### Liquidity Risk

**Figure 12.6** Balance Sheet of a Bank Following a $5 Million Withdrawal and Asset Adjustment

#### Withdrawal is Met by Selling Securities

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves</td>
<td>Deposits $95 million</td>
</tr>
<tr>
<td>Loans</td>
<td>Borrowed funds $30 million</td>
</tr>
<tr>
<td>Securities</td>
<td>Bank capital $20 million</td>
</tr>
<tr>
<td>$10 million</td>
<td>$95 million</td>
</tr>
<tr>
<td>$100 million</td>
<td>$30 million</td>
</tr>
<tr>
<td>$35 million</td>
<td>$20 million</td>
</tr>
</tbody>
</table>

#### Withdrawal is Met by Reducing Loans

<table>
<thead>
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<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves</td>
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</tr>
<tr>
<td>$10 million</td>
<td>$95 million</td>
</tr>
<tr>
<td>$95 million</td>
<td>$30 million</td>
</tr>
<tr>
<td>$40 million</td>
<td>$20 million</td>
</tr>
</tbody>
</table>
Credit Risk and Capital Adequacy

Consider two banks: one with high capital and one with low capital.

<table>
<thead>
<tr>
<th>Commercial Bank (Before)</th>
<th>Commercial Bank (After)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td><strong>Liabilities</strong></td>
</tr>
<tr>
<td>Reserves $10M</td>
<td>Deposits $90M</td>
</tr>
<tr>
<td>Loans (Mortgages, CRE)</td>
<td>Bank Capital (or “equity”) $10M</td>
</tr>
<tr>
<td>T-Bills Other bonds (GSEs)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reserves $10M</td>
</tr>
<tr>
<td></td>
<td>Deposits $90M</td>
</tr>
<tr>
<td></td>
<td>Loans (Mortgages, CRE)</td>
</tr>
<tr>
<td></td>
<td>T-Bills Other bonds (GSEs)</td>
</tr>
</tbody>
</table>

A $9 million loss leaves the high capital bank still solvent. However, the low capital bank is not so fortunate. In the case illustrated below, a $9 million loss wipes out bank capital. Since the loss exceeds the capital, the rest of the loss is incurred on the depositors.
<table>
<thead>
<tr>
<th>Commercial Bank (Before)</th>
<th>Commercial Bank (After)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assets</strong></td>
<td><strong>Liabilities</strong></td>
</tr>
<tr>
<td>Reserves</td>
<td>Deposits</td>
</tr>
<tr>
<td>$10M</td>
<td>$95M</td>
</tr>
<tr>
<td>Loans (Mortgages, CRE)</td>
<td>Bank Capital (or “equity”)</td>
</tr>
<tr>
<td>$90M</td>
<td>$5M</td>
</tr>
<tr>
<td>T-Bills</td>
<td></td>
</tr>
<tr>
<td>Other bonds (GSEs)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Assets</strong></td>
<td><strong>Liabilities</strong></td>
</tr>
<tr>
<td>Reserves</td>
<td>Deposits</td>
</tr>
<tr>
<td>$10M</td>
<td>$91M</td>
</tr>
<tr>
<td>Loans (Mortgages, CRE)</td>
<td>Bank Capital (or “equity”)</td>
</tr>
<tr>
<td>$81M</td>
<td>$0M</td>
</tr>
<tr>
<td>T-Bills</td>
<td></td>
</tr>
<tr>
<td>Other bonds (GSEs)</td>
<td></td>
</tr>
</tbody>
</table>

ROA = after tax profit/assets
ROE = after tax profits/capital
Net interest margin = net interest income/assets

Assume interest rate on assets is 5%, interest rate on deposits is 2%. Now compare the two ROE’s.

ROE for high capital bank: \( \frac{(0.05-0.02) \times 90}{10} = \frac{2.7}{10} = 0.27 \) (27%)
ROE for low capital bank: \( \frac{(0.05 \times 90)-(0.02 \times 95)}{5} = \frac{4.5-1.9}{5} = \frac{2.6}{5} = 0.52 \) (52%)

Hence there is an incentive to have high leverage.

**Interest Rate Risk**

Table 12.2 An Example of Interest-Rate Risk

<table>
<thead>
<tr>
<th></th>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interest-rate sensitive</td>
<td>$20</td>
<td>$50</td>
</tr>
<tr>
<td>Not interest-rate sensitive</td>
<td>$80</td>
<td>$50</td>
</tr>
<tr>
<td>Initial interest rate</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>New interest rate on interest-rate-sensitive assets and liabilities</td>
<td>5%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Revenue from Assets | Cost of Liabilities
---|---
At initial interest rate | \( (0.05 \times $20) + (0.05 \times $80) = $5.00 \)
After interest rate change | \( (0.06 \times $20) + (0.05 \times $80) = $5.20 \)
Profits at initial interest rate: \( ($5.00) - ($3.00) = $2.00 \) per $100 in assets
Profits after interest rate change: \( ($5.20) - ($3.50) = $1.70 \) per $100 in assets

Gap Analysis
Gap between interest-rate-sensitive assets and interest-rate-sensitive liabilities:
\( \text{(Interest-rate sensitive assets of $20)} - \text{(Interest-rate sensitive liabilities of $50)} = \text{(Gap of $-30)} \)
Trading Risk

Value at Risk (VaR): What is the most I can - with a 95% or 99% level of confidence - expect to lose in dollars over the next month (or quarter or year)?

http://www.investopedia.com/articles/04/092904.asp#axzz29y4NhSHp

Using the distribution of returns, one can answer this question. The issue is how to obtain the estimate the distribution. There are three approaches:

- Historical
- Variance-Covariance: assume Normal distribution, or mixture of Normals
- Monte Carlo: simulate distributions

Assume for the moment all that is being held in the portfolio is a single stock. Then one can examine the returns of this single stock.

In general, portfolios include more than one asset, so one would need to examine the distribution of returns for the portfolio. This depends upon the variances and most importantly covariances of the returns of the individual assets. When these are stable, then one can proceed as illustrated above.

This approach to risk management became quite popular in the mid-1990’s, particularly in the form of JP Morgan’s RiskMetrics.

There are many potential issues to contend with; for the approach to be accurate, especially when using the Variance-Covariance approach. With many assets in a typical portfolio, precise estimation of the covariances can be difficult (even if they remain stable over time). Also, the variance-covariance approach assumes that Normal distributions (or mixture of Normals) can properly describe asset returns.

For more, see Aswath Damodaran (NYU) notes on VaR:

http://people.stern.nyu.edu/adamodar/pdfiles/papers/VAR.pdf