MANAGING CREDIT RISK: 
THE CHALLENGE FOR THE NEW MILLENNIUM

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Credit Risk: A Global Challenge

In Low Credit Risk Regions (1998 - No Longer in 2003)

- New Emphasis on Sophisticated Risk Management and the Changing Regulatory Environment for Banks
- Refinements of Credit Scoring Techniques
- Large Credible Databases - Defaults, Migration
- Loans as Securities
- Portfolio Strategies
- Offensive Credit Risk Products
  - Derivatives, Credit Insurance, Securitizations
Credit Risk: A Global Challenge
(Continued)

In High Credit Risk Regions

• Lack of Credit Culture (e.g., Asia, Latin America), U.S. in 1996 - 1998?
• Losses from Credit Assets Threaten Financial System
• Many Banks and Investment Firms Have Become Insolvent
• Austerity Programs Dampen Demand - Good?
• Banks Lose the Will to Lend to “Good Firms” - Economy Stagnates
### Changing Regulatory Environment

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>Regulators recognized need for risk-based Capital for Credit Risk (Basel Accord)</td>
</tr>
<tr>
<td>1995</td>
<td>Capital Regulations for Market Risk Published</td>
</tr>
<tr>
<td>1996-98</td>
<td>Capital Regulations for Credit Derivatives</td>
</tr>
<tr>
<td>1997</td>
<td>Discussion of using credit risk models for selected portfolios in the banking books</td>
</tr>
</tbody>
</table>
| 1999 | New Credit Risk Recommendations  
- Bucket Approach - External and Possibly Internal Ratings  
- Expected Final Recommendations by Fall 2001  
- Postpone Internal Models (Portfolio Approach) |
| 2001 | Revised Basel Guidelines  
- Revised Buckets - Still Same Problems  
- Foundation and Advanced Internal Models |
| 2004 | Final Draft of Consultative Paper  
- Final Version - June, 2004  
- Implementation in 2007 |
# Capital Adequacy Risk Weights from Various BIS Accords

*(Corporate Assets Only)*

## Original 1988 Accord

<table>
<thead>
<tr>
<th>All Ratings</th>
<th>100% of Minimum Capital (e.g. 8%)</th>
</tr>
</thead>
</table>

## 1999 (June) Consultative BIS Proposal

<table>
<thead>
<tr>
<th>Rating/Weight</th>
<th>AAA to AA-</th>
<th>A+ to B-</th>
<th>Below B-</th>
<th>Unrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>100%</td>
<td>150%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

## 2001 (January) Consultative BIS Proposal

<table>
<thead>
<tr>
<th>Rating/Weight</th>
<th>AAA to AA-</th>
<th>A+ to A-</th>
<th>BBB+ to BB-</th>
<th>Below BB-</th>
<th>Unrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>50%</td>
<td>100%</td>
<td>150%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

## Altman/Saunders Proposal (2000,2001)

<table>
<thead>
<tr>
<th>Rating/Weight</th>
<th>AAA to AA-</th>
<th>A+ to BBB-</th>
<th>BB+ to B-</th>
<th>Below B-</th>
<th>Unrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>30%</td>
<td>100%</td>
<td>150%</td>
<td></td>
<td>Internally Based Approach</td>
</tr>
</tbody>
</table>
## Debt Ratings

<table>
<thead>
<tr>
<th>Moody's</th>
<th>S&amp;P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aaa</strong></td>
<td>AAA</td>
</tr>
<tr>
<td><strong>Aa1</strong></td>
<td>AA+</td>
</tr>
<tr>
<td><strong>Aa2</strong></td>
<td>AA</td>
</tr>
<tr>
<td><strong>Aa3</strong></td>
<td>AA-</td>
</tr>
<tr>
<td><strong>A1</strong></td>
<td>A+</td>
</tr>
<tr>
<td><strong>A2</strong></td>
<td>A</td>
</tr>
<tr>
<td><strong>A3</strong></td>
<td>A-</td>
</tr>
<tr>
<td><strong>Baa1</strong></td>
<td>BBB+</td>
</tr>
<tr>
<td><strong>Baa2</strong></td>
<td>BBB</td>
</tr>
<tr>
<td><strong>Baa3</strong></td>
<td>BBB-</td>
</tr>
<tr>
<td><strong>Ba1</strong></td>
<td>BB+</td>
</tr>
<tr>
<td><strong>Ba2</strong></td>
<td>BB</td>
</tr>
<tr>
<td><strong>Ba3</strong></td>
<td>BB-</td>
</tr>
<tr>
<td><strong>B1</strong></td>
<td>B+</td>
</tr>
<tr>
<td><strong>B2</strong></td>
<td>B</td>
</tr>
<tr>
<td><strong>B3</strong></td>
<td>B-</td>
</tr>
<tr>
<td><strong>Caa1</strong></td>
<td>CCC+</td>
</tr>
<tr>
<td><strong>Caa</strong></td>
<td>CCC</td>
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<td><strong>Caa3</strong></td>
<td>CCC-</td>
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<tr>
<td><strong>Ca</strong></td>
<td>CC</td>
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<tr>
<td><strong>C</strong></td>
<td>C</td>
</tr>
<tr>
<td><strong>CD</strong></td>
<td>D</td>
</tr>
</tbody>
</table>
Corporate Default Probabilities Typically Increase Exponentially Across Credit Grades
(2001 Consultative Paper)
Modified (2003) Corporate Risk Weight Curve

![Graph showing capital requirement vs. probability of default (bp)]
Recent Basel Credit Risk Management Recommendations

- Establishes a four-tier system for banks for use or not of internal rating systems to set regulatory capital. Ones that can set loss given default (LGD) estimates (**Advanced**) OR
- Banks that can only calculate default probability (PD), both expected and unexpected, may do so and have loss (recovery) probability estimates provided by regulators (**Foundation**) OR
- Banks that can do neither, or choose not to, can accept the **Standardized** approach whereby the weightings for each bucket are specified OR
- Central Banks may decide that some banks will remain unchanged, using Basel I. Is this consistent with encouraging improvements in risk managements?
- Revised plan provides substantial guidance for banks and regulators on what Basel Committee considers as a strong, best practice risk rating system.
- Basel Committee has developed capital charge for operational risk. Majority of small US banks probably not effected.
Some Recent Developments in Basel II

• Delay in 2003 due to decision to eliminate expected loss from the required capital (already in provisions?). Need to recalculate the weights including only unexpected losses.

• CP3 outlined compromise for recognition of reserves and others offsets to EL. All EL counted as part of EL. All other reserves (specific reserves, partial charges offs and “excess” general reserves) directly offset EL portion of risk weighted assets.

• Banks required to compare EL with Total Provisions: Any shortfall deducted from capital and Excess Reserves included in TIER2

• Expected adoption by mid-2004 and implementation in early 2007 or 2008.

• Top 10 US Banks will be mandated to adopt the Advanced IRB Approach and next 10-20 banks will have the option to do likewise. These banks involve 56% (Top 10) and 68% (Top 20) of Bank Assets in the US and over 95% of foreign bank assets in the US.
Some Recent Developments in Basel II

• The remainder of the US Banks (about 8000 smaller banks with 1/3 of the banking assets) will likely continue to operate under Basel I. No Foundation or Standardized approaches will be adopted.

• FDIC study finds US banks would realize reductions in capital from 18 - 40%. Expressed concern (9/12/03) that Basel II proposal could sharply reduce capital hampering the ability of US officials to prevent bank failures. Suggested minimum capital standards instead. Criticized both U.S. FED and OCC.

• In Europe, virtually 100% of the banking sector will adopt either the standardized or one of the more advanced approaches to calculating Required Bank Capital. Rest of the world?

• Target 8% required capital on risk weighted credit assets and weighted operating assets retained. Some reduction (25% maximum) for retail assets of US banks and even higher in Europe. Reductions also for SMES due to lower default correlations.
Basel II Final Release – June 26, 2004


Final Modifications to 2003 Consultative Paper
Credit Risk Modifications

• Endorsement by Central bank governors and heads of Supervision of G-10 countries.

• Two-stage adoption and implementation of the rules. More advanced approaches subject to a two-year parallel run period (with Basel I), but access to advantageous regulatory capital treatment from year-end 2007.

• Banks adopting the IRB approach for retail exposures can base capital requirements on this from year-end 2006 rather than waiting for year-end 2007.

• Revised treatment of Expected Loss and Provisions and also capital requirements for Defaulted Assets.
Expected Losses (‘‘EL’’)

- EL are now excluded from the risk weighting formulas and only the Unexpected Loss (‘‘UL’’) for IRB exposures are included.

- EL are treated separately and provisions held against IRB exposures are no longer automatically eligible for inclusions as Tier 2 capital; instead eligibility depends upon a comparison of provisions with EL (i.e. If provisions exceeded EL, then the excess can be counted toward Tier 2 capital up to a limit of 0.6% RWA; if, on the other hand, EL exceeds provisions then the amount of excess must be deducted 50% from Tier 1 and 50% from Tier 2.

- Capital requirements for defaulted assets will be based on a comparison between LGD vs. a bank’s best estimate of losses at the time of calculation.

- Reduction in the risk weights for certain specialized exposures, although the incentive for IRB remains.
Expected Losses (continued)

- Banks can now use their own risk parameter estimates for Asset Backed Commercial Paper exposures.

- For Banks adopting the IRB Foundation approach for purchased receivables, the LGD is reduced to 45% for senior claims.

- Relaxation of stress test for LGD estimates to “reflect economic downturn conditions when necessary” rather than “appropriate to an economic downturn”.
Key trends for Banks in the expected implementation of Basel II (excerpts from various consultant surveys)

• European banks are substantially in advance of their US and Asian counterparts in the planning and testing of IRB systems. Also greater sponsorship from more senior executives of the banks.

• Most banks expect significant organizational changes as well as corporate governance changes to result from the Basel II and Sarbanes-Oxley.

• Basel II is expected to significantly affect the competitive landscape, especially in retail banking, SME lending and in emerging markets. More robust risk-based pricing (i.e. more aggressive competition) to result favoring IRB banks.

• Planned spending on Basel II, while still substantial, seems lower than earlier studies indicated (maximum use of centralized solutions where new systems are required).
Banks targeting IRB- Advanced

Source: FT Research study commissioned by Accenture, Mercer Oliver Wyman and SAP (2004)
Expected Change in Capital Position

[Bar chart showing the expected change in capital position for different regions, with percentages indicating the expected outcomes.]

Source: FT Research study commissioned by Accenture, Mercer Oliver Wyman and SAP (2004)
Key trends for Banks in the expected implementation of Basel II (excerpt from various consultant surveys)

• Those banks not conforming to Basel II or using the standardized approach may become targets for larger-conforming banks for acquisition and leverage due to their excess capital and the transfer to Basel II capital requirements.

• Survey results show that banks regard more economically rational allocation of capital and more robust risk-based pricing as among the more important benefits from Basel II than potential improvements in regulatory capital ratios. Sadly, this may not manifest for the vast majority of U.S. banks who remain with Basel I (ed. note).

• Lack of meaningful IT involvement in U.S. and Asia.

• Less than half of the large banks are targeting advanced management approach (AMA) for operational risk implementation, much less than advanced IRB credit approaches.

• Significant work needs to be done to satisfy pillars 2 and 3 requirements.
Treatment of Small and Medium Sized Entities (SME)

• Much concern and fear as to how SMEs will be treated under Basel II.

• In fact, SMEs will likely be better-off than under the current Basel I framework.

• Under IRB approach for corporate credits, banks will be permitted to distinguish between exposures to SME borrowers (reported sales less than 50 million Euros) and larger corporates.

• Reduction of \((0.04 \times 1 - (S-5)/45)\) made to corporate weighting formula \((S=\text{Annual Sales}; \text{where } S= <5=5)\). Reduction less if the standardized approach is used.

• In most countries, e.g., Italy, one can probably expect a reduction, although trade-off between lower capital requirement and lower quality information and reporting on SME financial statements, i.e., higher PDs, could lessen reduction.

• New Basel calibration will reduce the likelihood that a credit crunch will ensue. Political considerations are evident in reduced capital for SME borrowers.
• Results of the Quantitative Impact Study 3.0 (2003) can be used to infer impact (based on 365 international bank sample).

• Distinction between group 1 (internationally active) banks and smaller, less complex banks (less than 3 billion euros of Tier I Capital).

• Results below in Table from EU sample of banks.

• Both the standardized and IRB approaches result in lower total regulatory capital with the impact greater when IRB methodology is applied. Perhaps due to recognition of collateral under IRB approach but not under standardized approach.

• Capital savings by smaller banks mainly due to lower capital on retail and small business portfolio. New capital requirement for operational risk is main item increasing total capital (see following Tables).
### Basel II Changes in Capital Requirements for European Group 1 (Large, Internationally Active) and Group 2 (Smaller, Capital Less Than 3 Billion Euro) Banks

(By Selected Portfolio Accounts)

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Group 1 Banks (%)</th>
<th>Group 2 Banks (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standardized</td>
<td>IRB-Advanced</td>
</tr>
<tr>
<td>Retail (Including Small Firms)</td>
<td>-4.72</td>
<td>-8.65</td>
</tr>
<tr>
<td>Corporate SMEs</td>
<td>-1.23</td>
<td>-5.05</td>
</tr>
<tr>
<td>Corporate</td>
<td>0.22</td>
<td>-2.84</td>
</tr>
<tr>
<td>Operational Risk</td>
<td>8.08</td>
<td>9.67</td>
</tr>
<tr>
<td>Bank</td>
<td>1.61</td>
<td>-0.53</td>
</tr>
<tr>
<td>Other</td>
<td>4.52</td>
<td>3.65</td>
</tr>
<tr>
<td>Total:</td>
<td><strong>8.48%</strong></td>
<td><strong>-3.75%</strong></td>
</tr>
</tbody>
</table>

*Source: European Commission Report (2003)*
A 2003 FDIC study estimates the capital impact of Basel II's advanced internal-ratings-based approach (A-IRB). Based on 19 years of financial data from all FDIC-insured commercial banks, the FDIC developed a range of values for the key Basel II risk parameters that banks might be expected to use over time. Major findings:

- Contrary to statements that Basel II will significantly change overall capital requirements, the FDIC expects large percentage reductions in risk-based capital requirements.
- During most of a typical economic cycle, risk-based capital requirements would be far below the levels needed for current Basel I requirements.
- Extremely wide cyclical swings in capital requirements for wholesale lending are likely unless banks' risk inputs are actively managed by supervisors to an extent not currently contemplated.
- The already wide disparity in core capital requirements between U.S. banks and other banks will be widened (Chart 1).
- Consequently, U.S. regulators will have to choose between ignoring the output of Basel II's formulas or sanction a weakening of the current capital adequacy framework (Chart 2).
- Other U.S. Banks regulators dispute FDIC conclusions.
Chart 1: Core Capital Requirements for U.S. Banks Far Exceed International Averages

Chart 2: Basel II Capital - Still Investment Grade?

The Importance of Credit Ratings

• For Risk Management in General
• Greater Understanding Between Borrowers and Lenders
• Linkage Between Internal Credit Scoring Models and Bond Ratings
• BIS Standards on Capital Adequacy
  – 8% Rule Now Regardless of Risk - Until 2004
  – Bucket Approach Based on External (Possibly Internal) Ratings
  – Model Approach - Linked to Ratings and Portfolio Risk (Postponed)
• Databases - Defaults and Migration
  – Statistics Based on Original (Altman-Mortality) and Cumulative (Static-Pool - S&P), Cohorts (Moody’s) Ratings
• Credit Derivatives
  – Price Linked to Current Rating, Default and Recovery Rates, arbitrage
• Bond Insurance Companies’
  – Rating (AAA) of these Firms
  – Rating of Pools that are Enhanced and Asset-Backed Securities (ABS)
Modified Corporate Risk Weight Curve
Changes from 2001 to 2003 Risk Weights

• The modified curve (QIS 2003) is generally lower than the curve proposed in the Committee’s January 2001 consultative paper. It is also considerably less steep overall.
• Main differential in capital requirements start at the BB level and lower.
• Asset correlations now vary from 0.24 at the lowest risk levels to 0.12 at the highest risk levels. It was 0.20 before for all levels of risk.
• Latest version permits banks to offset a portion of capital requirement with loan loss reserves, up to same limit.
• Less capital required for firms with EU 50m or less in Assets (SMEs)
• Complex adjustment for concentration of exposures to individual counter parties eliminated in newer QIS rules.
• Establishes 3 separate Retail Risk Curves (Residential, Credit levels, Other). 0.15 Asset Correlation assumption for all.
Modified (2003) Corporate Risk Weight Curve
Rating Systems

- **Bond Rating Agency Systems**
  - US (3) - Moody’s, S&P (20+ Notches), Fitch/IBCA
- **Bank Rating Systems**
  - 1→9, A→F, Ratings since 1995 (Moody’s and S&P)
- **Office of Controller of Currency System**
  - Pass (0%), Substandard (20%), Doubtful (50%), Loss (100%)
- **NAIC (Insurance Agency)**
  - 1→6
- **Local Rating Systems**
  - Three (Japan)
  - SERASA (Brazil)
  - RAM (Malaysia)
  - New Zealand (NEW)
  - etc.
Scoring Systems

• Qualitative (Subjective)

• Univariate (Accounting/Market Measures)

• Multivariate (Accounting/Market Measures)
  – Discriminant, Logit, Probit Models (Linear, Quadratic)
  – Non-Linear Models (e.g., RPA, NN)

• Discriminant and Logit Models in Use
  – Consumer Models - Fair Isaacs
  – Z-Score (5) - Manufacturing
  – ZETA Score (7) - Industrials
  – Private Firm Models (eg. Risk Calc (Moody’s), Z” Score)
  – EM Score (4) - Emerging Markets, Industrial
  – Other - Bank Specialized Systems
Scoring Systems
(continued)

• Artificial Intelligence Systems
  – Expert Systems
  – Neural Networks (eg. Credit Model (S&P), CBI (Italy))

• Option/Contingent Models
  – Risk of Ruin
  – KMV Credit Monitor Model
## Rating System: An Example

**PRIORITITY: Map Internal Ratings to Public Rating Agencies**

<table>
<thead>
<tr>
<th>Internal Credit Ratings</th>
<th>Code</th>
<th>Meaning</th>
<th>Corresponding Moody's</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>Exceptional</td>
<td>Aaa</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>Excellent</td>
<td>Aa1</td>
</tr>
<tr>
<td>3</td>
<td>C</td>
<td>Strong</td>
<td>Aa2/Aa3</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>Good</td>
<td>A1/A2/A3</td>
</tr>
<tr>
<td>5</td>
<td>E</td>
<td>Satisfactory</td>
<td>Baa1/Baa2/Baa3</td>
</tr>
<tr>
<td>6</td>
<td>F</td>
<td>Adequate</td>
<td>Ba1</td>
</tr>
<tr>
<td>7</td>
<td>G</td>
<td>Watch List</td>
<td>Ba2/Ba3</td>
</tr>
<tr>
<td>8</td>
<td>H</td>
<td>Weak</td>
<td>B1</td>
</tr>
<tr>
<td>9</td>
<td>I</td>
<td>Substandard</td>
<td>B2/B3</td>
</tr>
<tr>
<td>10</td>
<td>L</td>
<td>Doubtful</td>
<td>Caa - O</td>
</tr>
<tr>
<td>N</td>
<td></td>
<td>In Elimination</td>
<td></td>
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<tr>
<td>S</td>
<td></td>
<td>In Consolidation</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td></td>
<td>Pending Classification</td>
<td></td>
</tr>
</tbody>
</table>
Basic Architecture of an Internal Ratings-Based (IRB) Approach to Capital

• In order to become eligible for the IRB approach, a bank would first need to demonstrate that its internal rating system and processes are in accordance with the minimum standards and sound practice guidelines which will be set forward by the Basel Committee.

• The bank would furthermore need to provide to supervisors exposure amounts and estimates of some or all of the key loss statistics associated with these exposures, such as Probability of Default (PD), by internal rating grade (Foundation Approach).

• Based on the bank’s estimate of the probability of default, as well as the estimates of the loss given default (LGD) and maturity of loan, a bank’s exposures would be assigned to capital “buckets” (Advanced Approach). Each bucket would have an associated risk weight that incorporates the expected (up to 1.25%) and unexpected loss associated with estimates of PD and LGD, and possibly other risk characteristics.
Loss Given Default

• Standardized and Foundation Approaches allow for a maximum 55% of recovery (45% LGD) on the equivalent of unsecured credit assets.

• Collateral (Secured) Credit Assets allowed either 60% recovery (40% LGD) or 65% recovery (35% recovery) on specified assets (e.g. receivables (40% LGD) and real estate (35% LGD)).

• Advanced approach LGD determined from rigorously tested recovery data.

• Open issues – Time Series Recovery, Predictability of PD and LGD and Correlation Between Default and Recovery Rates.
## Risk Weights for Sovereign and Banks
*(Based on January 2001 BIS Proposal)*

### Sovereigns

<table>
<thead>
<tr>
<th>Credit Assessment of Sovereign</th>
<th>AAA to AA-</th>
<th>A+ to A-</th>
<th>BBB+ to BBB-</th>
<th>BB+ to B-</th>
<th>Below B-</th>
<th>Unrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sovereign risk weights</td>
<td>0%</td>
<td>20%</td>
<td>50%</td>
<td>100%</td>
<td>150%</td>
<td>100%</td>
</tr>
<tr>
<td>Risk weights of banks</td>
<td>20%</td>
<td>50%</td>
<td>100%</td>
<td>100%</td>
<td>150%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Suggestions (Altman):
* Add a BB+ to BB- Category = 75%
* Eliminate Unrated Category and Use Internal Ratings
## Risk Weights for Sovereign and Banks
*(Based on January 2001 BIS Proposal)* (continued)

### Banks

<table>
<thead>
<tr>
<th>Credit Assessment of Banks</th>
<th>AAA to AA-</th>
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<th>BBB+ to BBB-</th>
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<td>20%</td>
<td>50%</td>
<td>50%</td>
<td>100%</td>
<td>150%</td>
<td>50%</td>
</tr>
<tr>
<td>Risk weights for short-term claims</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
<td>50%</td>
<td>150%</td>
<td>20%</td>
</tr>
</tbody>
</table>
BIS Collateral Proposals

- January 2001 Proposal introduced a W-factor on the extent of risk mitigation achieved by collateral

  - **W-factor** is a minimum floor beyond which collateral on a loan cannot reduce the risk-weight to zero. Main rationale for the floor was “legal uncertainty” of collecting on the collateral and its price volatility

- September 2001 amendment acknowledges that legal uncertainty is already treated in the Operational Risk charge and proposes the the W-factor be retained but moved form the Pillar 1 standard capital adequacy ratio to Pillar 2’s Supervisory Review Process in a qualitative sense

- \[
\text{Capital Ratio} = \frac{\text{Capital}}{\sum \text{Risk Weighted Assets}}
\]

  - Collateral Value (CV) impacts the denominator
  - More CV the lower the RWA. Leads to a higher capital ratio on the freeing up of capital while maintaining an adequate Capital Ratio
  - CV is adjusted based on 3 Haircuts:
    - HE based on volatility of underlying exposure
    - HC based on volatility of collateral
    - HFX BASED on possible currency mismatch
BIS Collateral Proposals (continued)

• **Simple Approach** for most Banks (Except Most Sophisticated)
  – Partial collateralization is recognized
  – Collateral needs to be pledged for life of exposure
  – Collateral must be marked-to-market
  – Collateral must be revalued with a minimum of six months
  – Floor of 20% except in special Repo cases

• **Constraint on Portfolio Approach** for setting collateral standards – Correlation and risk through Systematic Risk Factors (still uncertain and not established)
Relative Capital Allocation of Risk for Banks
(Based on Basel II Guidelines – Proposed)

SAMPLE ECONOMIC CAPITAL ALLOCATION FOR BANKS

CREDIT RISK COMPONENTS

- Default Probability
- Default Severity
- Migration Probabilities

CREDIT RISK PARAMETERS

- Scoring Models
- Recovery Rates
- Transition Matrices

Operating
Market/ALM
Credit
Expected Loss Can Be Broken Down Into Three Components

\[
\text{EXPECTED LOSS} = \text{Borrower Risk} \times \text{Facility Risk Related}
\]

- **Borrower Risk**
  - Probability of Default (PD) [%]
  - What is the probability of the counterparty defaulting?

- **Facility Risk Related**
  - Loss Severity Given Default (Severity) [%]
  - If default occurs, how much of this do we expect to lose?
  - Loan Equivalent Exposure (Exposure) [$$]
  - If default occurs, how much exposure do we expect to have?

The focus of grading tools is on modeling PD
### The Starting Point is Establishing a Universal Rating Equivalent Scale for the Classification of Risk

<table>
<thead>
<tr>
<th>CREDIT GRADES</th>
<th>RISK LEVEL</th>
<th>PD (bp)</th>
<th>S&amp;P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minimal</td>
<td>0-1</td>
<td>AAA</td>
</tr>
<tr>
<td>2</td>
<td>Modest</td>
<td>2-4</td>
<td>AA</td>
</tr>
<tr>
<td>3</td>
<td>Average</td>
<td>5-10</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td>Acceptable</td>
<td>11-50</td>
<td>BBB</td>
</tr>
<tr>
<td>5</td>
<td>Acceptable with care</td>
<td>51-200</td>
<td>BB</td>
</tr>
<tr>
<td>6</td>
<td>Management Attention</td>
<td>201-1000</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td><strong>Performing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Special Mention</td>
<td>1000+</td>
<td>CCC</td>
</tr>
<tr>
<td>8</td>
<td>Substandard</td>
<td>Interest Suspense</td>
<td>CCC / CC</td>
</tr>
<tr>
<td>9</td>
<td>Doubtful</td>
<td>Provision</td>
<td>CC / C</td>
</tr>
<tr>
<td>10</td>
<td>Loss</td>
<td>Default / Loss</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td><strong>Substandard</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
At the Core of Credit Risk Management Are Credit Scoring/Grading Models

- Loan scoring / grading is not new, but as part of BIS II it will become much more important for banks to get it right

- Building the models and tools
  - Number of positives and negatives
  - Factor / Variable selection
  - Model construction
  - Model evaluation
  - From model to decision tool

- “Field performance” of the models
  - Stratification power
  - Calibration
  - Consistency
  - Robustness

- Application and use tests
  - Importance of education across the Bank
Now That the Model Has Been in Use, How Can We Tell If It’s Any Good?

- There are four potentially useful criteria for evaluating the field performance of a scoring or grading tool:
  - **Stratification**: How good are the tools at stratifying the relative risk of borrowers?
  - **Calibration**: How close are actual vs. predicted defaults, both for the book overall and for individual credit grades?
  - **Consistency**: How consistent are the results across the different scorecards?
  - **Robustness**: How consistent are the results across Industries, over time and across the Bank

- Stratification is about ordinal ranking (AA grade has fewer defaults than A grade)

- Calibration is about cardinal ranking (getting the right number of defaults per grade)

- Consistency concerns the first two criteria across different models:
  - Different industries or countries within Loan Book (LOB)
  - Across LOBs (e.g. large corporate, middle market, small business)

- Especially for high grades (BBB and above), field performance is hard to assess accurately
Some Comments on Performance “In the Field”

• Backtesting à la VaR models is very hard, practically:
  – Lopez & Saidenberg (1998) show how hard this is and propose a simulation-based solution
  – Prior criteria (stratification, calibration, consistency, robustness) may be more practical

• What you can get in \( N \) can you get in \( T \) ?
  – Hard to judge performance from one year (\( T = 1 \)); might need multiple years
  – However: difficult to assume within year independence
    › Macroeconomic conditions affect everybody
    › This will affect the statistics
  – A test for grading tools: how do they fare through a recession
    › During expansion years: expect “too few” defaults
    › During recession years: expect “too many” defaults

• Two schools of credit assessment:
  – Unconditional (“Through-the-cycle”): ratings from agencies are sluggish / insensitive
  – Conditional (“Mark-to-market”): KMV’s stock price-based PDs are sensitive / volatile / timely
    Z-Scores based PDs are sensitive / less volatile / less timely
Many Internal Models are Based on Variations of the Altman’s Z-Score and Zeta Models

- Altman (1968) built a linear discriminant model based only on financial ratios, matched sample (by year, industry, size)

\[
Z = 1.2 \, X_1 + 1.4 \, X_2 + 3.3 \, X_3 + 0.6 \, X_4 + 1.0 \, X_5
\]

- Most credit scoring models use a combination of financial and non-financial factors

<table>
<thead>
<tr>
<th>Financial Factors</th>
<th>Non-financial Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt service coverage</td>
<td>Size</td>
</tr>
<tr>
<td>Leverage</td>
<td>Industry</td>
</tr>
<tr>
<td>Profitability</td>
<td>Age / experience of key managers</td>
</tr>
<tr>
<td>Liquidity</td>
<td>ALM</td>
</tr>
<tr>
<td>Net worth</td>
<td>Location</td>
</tr>
</tbody>
</table>

X_1 = \frac{\text{working capital}}{\text{total assets}}

X_2 = \frac{\text{retained earnings}}{\text{total assets}}

X_3 = \frac{\text{earning before interest and taxes}}{\text{total assets}}

X_4 = \frac{\text{market value of equity}}{\text{book value of total liabilities}}

X_5 = \frac{\text{sales}}{\text{total assets}}
Decision Points When Building a Model

• Sample selection:
  – How far back do you go to collect enough “bads”? 
  – Ratio of “goods” to “bads”?

• Factor or variable selection
  – Financial factors
    › Many financial metrics are very similar – highly correlated
  – Non-financial factors
    › More subject to measurement error and subjectivity

• Model selection
  – Linear discriminant analysis (e.g. Altman’s Z-Score, Zeta models)
  – Logistic regression
  – Neural network or other machine learning methods (e.g. CART)
  – Option based (e.g. KMV’s CreditMonitor) for publicly traded companies

• Model evaluation
  – In-sample
  – Out-of-sample (“field testing”)

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All Model Evaluation is Done on the Basis of Error Rate Analysis

- In binary event modeling ("goods" vs. "bads"), the basic idea is correct classification and separation
- There is a battery of statistical tests which are used to help us with selecting among competing models and to assess performance

2x2 Confusion / Classification Table

<table>
<thead>
<tr>
<th>Predicted Negatives</th>
<th>Predicted Positives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Negatives</strong></td>
<td>True Negatives</td>
</tr>
<tr>
<td></td>
<td>False Positives (type I error)</td>
</tr>
<tr>
<td><strong>Actual Positives</strong></td>
<td>False Negatives (type II error)</td>
</tr>
<tr>
<td></td>
<td>True Positive</td>
</tr>
</tbody>
</table>

- Error Rate = false negatives + false positives
- Note that you may care very differently about the two error types
- Cost of Type I usually considerably higher (e.g. 15 to 1)
It is One Thing to Measure Risk & Capital, It is Another to Apply and Use the Output

- There are a host of possible applications of a risk and capital measurement framework:
  - Risk-adjusted pricing
  - Risk-adjusted compensation
  - Limit setting
  - Portfolio management
  - Loss forecasting and reserve planning
  - Relationship profitability

- Banks and supervisors share similar (but not identical) objectives, but both are best achieved through the use and application of a risk and capital measurement framework

<table>
<thead>
<tr>
<th>SUPERVISOR</th>
<th>BANK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Adequacy</td>
<td>Capital Efficiency</td>
</tr>
<tr>
<td>“Enough Capital”</td>
<td>“Capital Deployed</td>
</tr>
<tr>
<td></td>
<td>Efficiently”</td>
</tr>
</tbody>
</table>
Applications Include Risk-Adjusted Pricing, Performance Measurement and Compensation

- At a minimum, risk-adjusted pricing means covering expected losses (EL)
  - Price = LIBOR + EL + (fees & profit)

- If a credit portfolio model is available, i.e. correlations and concentrations are accounted for, we can do contributory risk-based pricing
  - Price = LIBOR + EL + CR + (fees & profit)
  - Basic idea: if marginal loan is diversifying for the portfolio, maybe able to offer a discount, if concentrating, charge a premium

- With the calculation of economic capital, we can compute RAROC (risk-adjusted return to [economic] capital) - Returns relative to standard measure of risk
  - Used for LOB performance measurement by comparing RAROCs across business lines
  - Capital attribution and consumption
  - Input to compensation, especially for capital intensive business activities (e.g. lending, not deposits)
  - Capital management at corporate level
Four A’s of Capital Management

• **Adequacy:** Do we have enough capital to support our overall business activities?
  - Banks usually do: e.g. American Express (2000)
  - Some Non-Banks sometimes do not: e.g. Enron (2001)

• **Attribution:** Is business unit / line of business risk reflected in their capital attribution, and can we reconcile the whole with the sum of the parts?

• **Allocation:** To which activities should we deploy additional capital? Where should capital be withdrawn?

• **Architecture:** How should we alter our balance sheet structure?
Minimum BIS Conditions for Collateral Transactions to be Eligible for Credit Mitigation

- Legal Certainty
- Low Correlation with Exposure
- Robust Risk Management Process
- Focus on Underlying Credit
- Continuous and Conservative Valuation of Tranches
- Policies and Procedures
- Systems for Maintenance of Criteria
- Concentration Risk Consideration
- Roll-off Risks
- External Factors
- Disclosure
Methodologies for Proposed Treatments of Collateralized Transactions

- **Comprehensive** - Focuses on the Cash Value of the Collateral taking into consideration its price volatility. Conservative valuation and partial collateralization haircuts possible based on volatility of exposure [OR]

- **Simple** - Maintains the substitution approach of the present Accord -- Collateral issuer’s risk weight is substituted for the underlying obligor.

Note: Banks will be permitted to use either the comprehensive or simple alternatives provided they use the chosen one consistently and for the entire portfolio.
Opportunities and Responsibilities for Regulators of Credit Risk

- Assumes Acceptance of Revised BIS Guidelines
  - Bucket Approach
  - 2004 Application

- Sanctioning of Internal Rating Systems of Banks
  - Comprehensiveness of Data
  - Integrity of Data
  - Statistical Validity of Scoring Systems
  - Linkage of Scoring System to Ratings (Mapping)
Opportunities and Responsibilities for Regulators of Credit Risk (continued)

• Linkage of Rating System to Probability of Default (PD) Estimation
  – Mapping of Internal Ratings with Local Companies’ External Ratings
  – Mapping of External Ratings of Local Company with International Experience (e.g. S&P)

• Loss Given Default (LGD) Estimation
  – Need for a Centralized Data Base on Recoveries by Asset Type and Collateral and Capital Structure
  – Crucial Role of Central Banks as Coordinator and Sanctioner
  – Similar Roles in Other Countries, i.e. Italy, U.S., Brazil, by Various Organizations, e.g. Bank Consortium, Trade Association or Central Banks.
Proposed Operational Risk Capital Requirements

Reduced from 20% to 12% of a Bank’s Total Regulatory Capital Requirement (November, 2001)

Based on a Bank’s Choice of the:

(a) **Basic Indicator Approach** which levies a single operational risk charge for the entire bank

    or

(b) **Standardized Approach** which divides a bank’s eight lines of business, each with its own operational risk charge

    or

(c) **Advanced Management Approach** which uses the bank’s own internal models of operational risk measurement to assess a capital requirement
Number of Non-Impaired Grades

Number of Impaired Grades

Rating Coverage

Calculation of Internal Capital Estimates

Risk Based Pricing Framework

Price (Interest Rate) = Cost of Funds + Credit Charge + Loan Overhead & Operating Risk
Proposed Credit Risk Pricing Model

Credit Charge = Risk Charge + Overheads

Expected Loss Charge

Default Rate

1-Recovery Rate

Hurdle Rate

Capital at Risk

Capital at Risk
An Alternative Structure For Estimating Expected Loss

\[ EL(\$) = P_{D,R} \% \times [(\text{Exp}(\$) - \text{CRV}(\$)) \times (1 - \text{UNREC}(\%))] \]

where:
\( P_{D,R} \) = Probability of Default in Credit Rating Class R
\( \text{EXP} \) = Exposure of Loan Facility
\( \text{CRV} \) = Collateral Recovery Value on Loan Facility
\( \text{UNREC} \) = Expected Recovery Rate on Unsecured Facilities
Risk Based Pricing: An Example

Given: 5-Year Senior Unsecured Loan
Risk Rating = BBB
Expected Default Rate = 0.3% per year (30 b.p.)
Expected Recovery Rate = 70%
Unexpected Loss (σ) 50 b.p. per year
BIS capital Allocation = 8%
Cost of Equity Capital = 15%
Overhead + Operations Risk Charge = 40 b.p. per year
Cost of Funds = 6%

Loan
\[ \text{Price}_{(1)} = 6.0\% + (0.3\% \times [1-.7]) + (6 \times 0.5\% \times 15\%) + 0.4\% = 6.94\% \]

Or

Loan
\[ \text{Price}_{(2)} = 6.0\% + (0.3\% \times [1-.7]) + (8.0\% \times 15\%) + 0.4\% = 7.69\% \]

(1) Internal Model for Capital Allocation
(2) BIS Capital Allocation method
Bank Loans Vs. Bonds*

Although many corporations issue both bank loans and bonds, there are several distinguishing features which could make bank loans attractive to investors.

<table>
<thead>
<tr>
<th></th>
<th>Bank Loans</th>
<th>Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claim on Assets</td>
<td>Senior</td>
<td>Subordinated</td>
</tr>
<tr>
<td>Collateral</td>
<td>Secured</td>
<td>Mostly Unsecured</td>
</tr>
<tr>
<td>Rate</td>
<td>Floating</td>
<td>Fixed</td>
</tr>
<tr>
<td>Principal Repayment</td>
<td>Amortizing</td>
<td>At Call or Maturity</td>
</tr>
<tr>
<td>Covenant Package</td>
<td>Restrictive</td>
<td>Less Restrictive</td>
</tr>
<tr>
<td>Mandatory Prepayments</td>
<td>In Most Cases</td>
<td>Some Cases</td>
</tr>
</tbody>
</table>

* Typical Structures
New-Issue Leveraged Loan Volume in US Dollars*

Source: S&P, Loan Pricing Corporation

*Commercial loans with spreads of LIBOR + 150 bps or more. Includes New Issuances only.

Data for 1993-1999 has been adjusted for restatement of terms based on 1999 data
Over this period, credit markets have evolved beyond recognition

Syndication was the industry's first risk management and distribution technique for commercial loans

Data Source: LPC (US)
Secondary Loan Trading Volume

U.S. Loans Secondary Trading

Source: S&P, Loan Pricing Corporation

*Commercial loans with spreads of LIBOR + 150 bps or more
Secondary Loan Trading Volume - Par Vs. Distressed

Source: Loan Pricing Corp.
Comparison of Distribution of Credit Returns and Market Returns

Source: CreditMetrics Technical Document
CreditMetrics™ Framework

Exposures

- User Portfolio
- Market Volatilities
- Exposure Distributions

Value At Risk Due To Credit

- Credit Rating
- Seniority
- Credit Spreads

- Rating Migration Likelihood
- Recovery Rate in Default
- Present Value Bond Revaluation

Correlations

- Ratings Series, Equity Series
- Model (e.g., Correlations)
- Joint Credit Ratings

Portfolio Value at Risk Due to Credit

Standard Deviation of Value Due to Credit Quality Changes for a Single Exposure

Source: J.P. Morgan, 1997
Credit Risk Measurement Tools

- JP Morgan’s CreditMetrics™
- CSFP’s CreditRisk+™
- KMV’s Credit Monitor™
- McKinsey’s CreditPortfolio View™
- Others: Algorithmics, Kamakura, Consulting Companies
Sample CLO Transaction Structure

**Bank**

**Seller/Servicer/Asset Manager**

(Assigns portfolio of loans to the issuer of rated securities, monitors portfolio performance, and performs credit evaluation, loan surveillance, and collections)

**Issuer (Trust)**

(Purchases loans and issues ABS, using loans as collateral)

**Trustee**

(Protects investor’s security interest in the collateral, maintains cash reserve accounts, and performs other duties)

**Swap Counterparty**

(Provides swap to hedge against currency and/or interest-related risk)

**Investors**

(Buy Rated ABS)

Assignment Agreements

CLO - Collateralized Loan Obligation

ABS - Asset-backed Securities
CLO Example

Pool of Loans From Bank
- 100 Loans
- $1 Billion Pool
- Average Rating = BBB
- Average i = .10 (F Rate)

Trustee

Fees = 1% of pool

SPV

Sell Loans

$1 Billion

Swap Counterpart

<table>
<thead>
<tr>
<th>Tranche</th>
<th>Size (%)</th>
<th>i</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior</td>
<td>70%</td>
<td>.08</td>
<td>AA</td>
</tr>
<tr>
<td>Junior</td>
<td>20%</td>
<td>.11</td>
<td>BB</td>
</tr>
<tr>
<td>Equity</td>
<td>10%</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
CLO Example

**Returns with No Defaults:** Returns to ABS

<table>
<thead>
<tr>
<th></th>
<th>First Year</th>
<th>Second Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Interest</td>
<td>$100 million</td>
<td>$100 million</td>
</tr>
<tr>
<td>Interest to Senior</td>
<td>$56 million</td>
<td>$56 million</td>
</tr>
<tr>
<td>Fees</td>
<td>$10 million</td>
<td>--</td>
</tr>
<tr>
<td>Net From Jr.</td>
<td>$34 million</td>
<td>$44 million</td>
</tr>
<tr>
<td>Interest to Jr.</td>
<td>$22 million</td>
<td>$22 million</td>
</tr>
<tr>
<td>Net to Equity</td>
<td>$12 million</td>
<td>$22 million</td>
</tr>
<tr>
<td>ROE</td>
<td>???</td>
<td>???</td>
</tr>
</tbody>
</table>
### Growth in the Credit Derivative Market (Notional Amounts)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>US$ Billions</td>
<td>180</td>
<td>350</td>
<td>590</td>
<td>890</td>
<td>1,200</td>
<td>2,300</td>
<td>3,600*</td>
<td>5,100*</td>
</tr>
</tbody>
</table>

*Source: Risk, February 2003 (*estimated)*
## Credit Derivative Products

### Structures

<table>
<thead>
<tr>
<th>• Total Return Swap</th>
<th>• Credit Swap</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Default Contingent Forward</td>
<td>• Credit Linked Note</td>
</tr>
<tr>
<td></td>
<td>• Spread Forward</td>
</tr>
<tr>
<td></td>
<td>• Spread Option</td>
</tr>
</tbody>
</table>

### Underlying Assets

<table>
<thead>
<tr>
<th>• Corporate Loans</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Corporate Bonds</td>
</tr>
<tr>
<td>• Sovereign Bonds/Loans</td>
</tr>
<tr>
<td>• Specified Loans or Bonds</td>
</tr>
<tr>
<td>• Portfolio of Loans or Bonds</td>
</tr>
</tbody>
</table>
Credit Risk Derivative Contract Time Line

Contract Date

Default Date

Corporate Borrower (Third Party)

Credit Risk Seller (Protection Buyer)

Credit Risk Buyer (Protection Seller)

I

I

I

I

I

I

P

P

P

P

DR

I + FV

I = Interest (fixed or floating rate) on underlying asset, e.g. bond

P = Premium on credit derivative contract

DR = Default recovery - either sale proceeds or delivery of underlying asset

FV = Face value at maturity of underlying asset
### Participants and Strategies in the Credit Default Swap Market (2003)

<table>
<thead>
<tr>
<th></th>
<th>Buy/Sell</th>
<th>Reason</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banks</td>
<td>Both</td>
<td>Regulatory Capital Relief; Credit Risk Management ; Geographic/Industry Diversification of Lending Portfolio</td>
<td>39.2%</td>
</tr>
<tr>
<td>Insurance Cos.</td>
<td>Seller</td>
<td>Asset Portfolio: Yield Enhancement, Diversification</td>
<td>13.6%</td>
</tr>
<tr>
<td>Hedge Funds</td>
<td>Buyer</td>
<td>Isolate Equity Optionality and Express Negative Views; Convertible and Capital Structure Arbitrage</td>
<td>13.0%</td>
</tr>
<tr>
<td>Synthetic CDOs</td>
<td>Seller</td>
<td>Yield Enhancement, Diversification</td>
<td>10.0%</td>
</tr>
<tr>
<td>Reinsurers</td>
<td>Seller</td>
<td>Alternative to Writing Insurance; Diversification</td>
<td>9.9%</td>
</tr>
<tr>
<td>Fund Managers</td>
<td>Both</td>
<td>Strategic Trade Construction; Yield Enhancement</td>
<td>6.8%</td>
</tr>
<tr>
<td>Corporations</td>
<td>Buyer</td>
<td>Vendor financing/Accounts Receivable Credit Risk Management</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

*Source: Risk, February 2003 (*estimated)*
CDS Market Indexes

• **TRAC-X** (from Morgan Stanley/J.P.Morgan)
  - Created to represent regional CDS markets (e.g. Europe, U.S.). Launched in April, 2003.
  - Comprised of 100 of most actively traded individual corporate names (mainly Investment Grade).
  - Total Return Benchmark of movement in prices of the 100 corporates.
  - Excludes restructuring as an event.
  - New partnership with Dow Jones (13 global indexes)

• **CDX** (from Consortium of 11 major Banks)
  - Launched in October, 2003 (Investment Grade) and November (Non-investment Grade, IBOXX CDX.NA.HY).
  - Comprised of 125 credits, split into five rating categories.
  - Competitive product to TRAC-X.
Recommendations for Credit Risk Management

A. Making Risks Visible, Measurable, and Manageable

• Meaningful Credit Culture Throughout
• Consistent and Comprehensive Scoring System
• From Scoring to Ratings
• Expected Risk (Migration, Loss) and Returns - Market and/or Bank Data Bases
• Individual Asset and Concentration Risk Measurements
• Reflect Risks in Pricing - NPV, Portfolio, RAROC Approaches
• Marking to Market
• Measure Credit Risk Off-Balance Sheet - Netting
  – Futures, Options, Swaps
Recommendations for Credit Risk Management

(continued)

B. Organizational Strategic Issues

• Centralized vs. Decentralized
• Specialized Credit and Underwriting Skills vs. Local Knowledge
• Establishing an Independent Workout Function
• Managing Good vs. Bad Loans
• To Loan Sale or Not
• Credit Derivatives
• Credit Risk of Derivatives