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
- Enormous defaults and bankruptcies in US in 2001/2002.
- 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

1988	Regulators recognized need for risk-based Capital for Credit Risk (Basel Accord)
1995	Capital Regulations for Market Risk Published
1996-98	Capital Regulations for Credit Derivatives
1997	Discussion of using credit risk models for selected portfolios in the banking books
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

All Ratings	100% of Minimum Capital (e.g. 8%)

1999 (June) Consultative BIS Proposal

Rating/Weight			
AAA to AA-	A+ to B-	Below B-	Unrated
20%	100%	150%	100%

2001 (January) Consultative BIS Proposal

AAA to AA-	A+ to A-	BBB+ to BB-	Below BB-	Unrated
20%	50%	100%	150%	100%

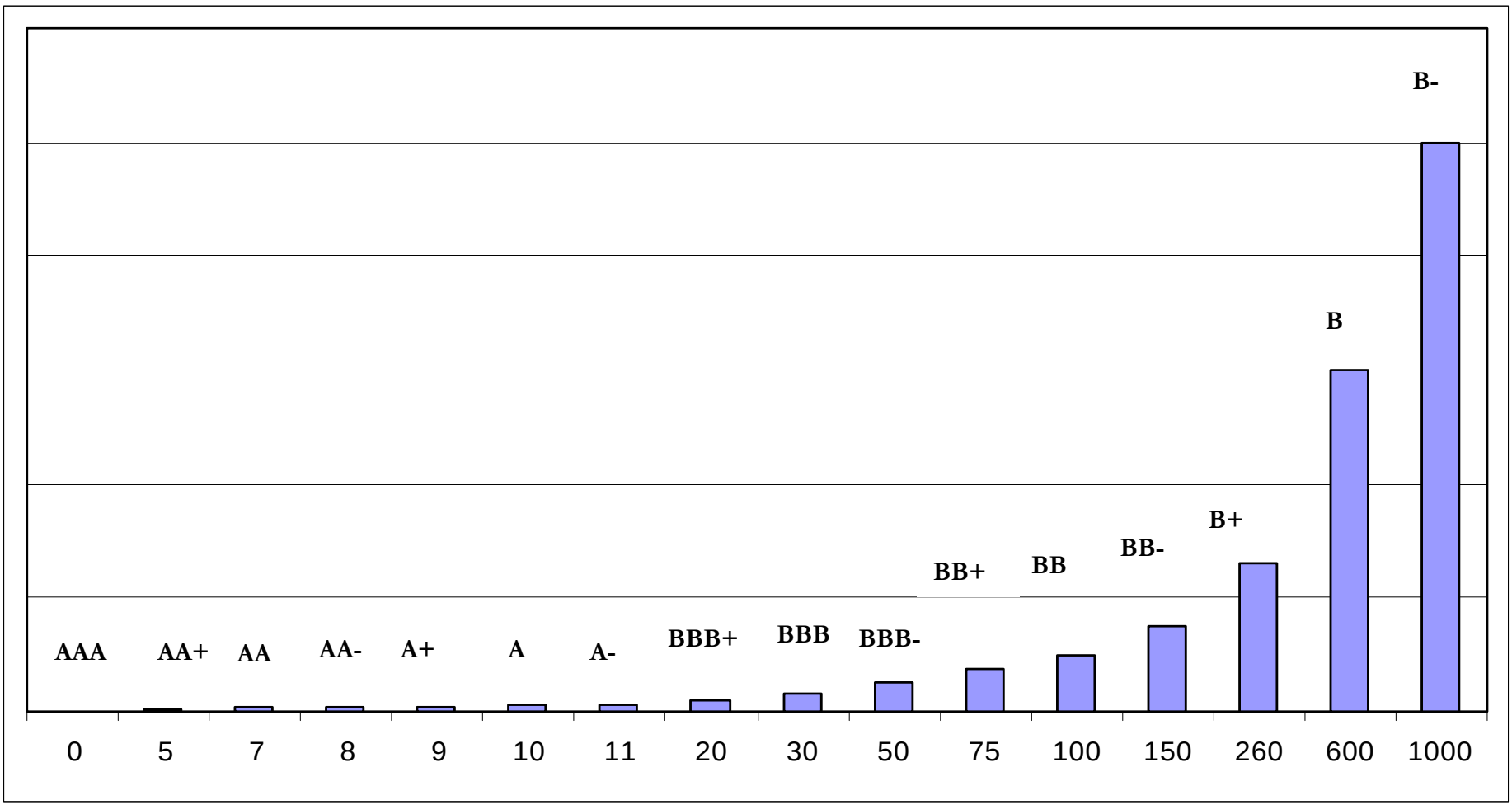
Altman/Saunders Proposal (2000,2001)

AAA to AA-	A+ to BBB-	BB+ to B-	Below B-	Unrated
10%	30%	100%	150%	Internally Based Approach

Debt Ratings

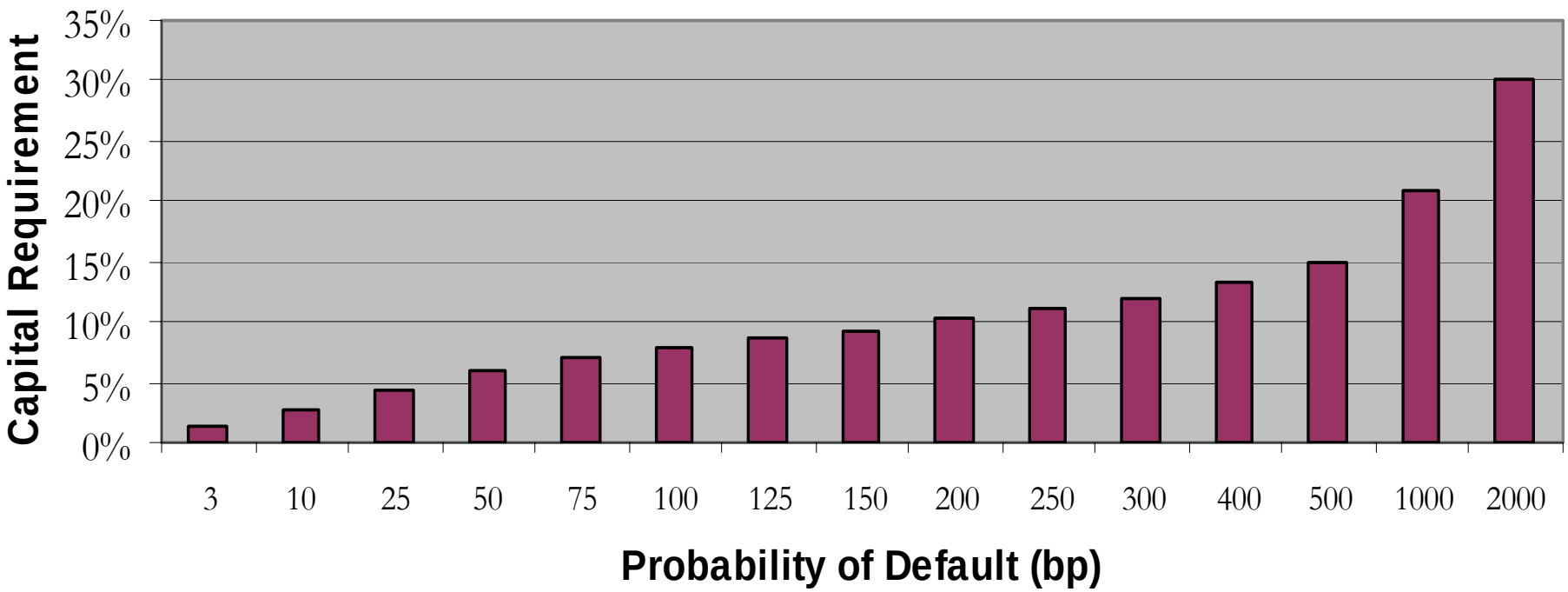
Moody's		S&P
Aaa		AAA
Aa1		AA+
Aa2		AA
Aa3		AA-
A1		A+
A2		A
A3		A-
Baa1		BBB+
Baa2	Investment	BBB
Baa3	Grade	BBB-
Ba1	High Yield	BB+
Ba2		BB
Ba3		BB-
B1		B+
B2		B
B3		B-
Caa1		CCC+
Caa		CCC
Caa3		CCC-
Ca		CC
		C
C		D

Corporate Default Probabilities Typically Increase Exponentially Across Credit Grades (2001 Consultative Paper)



Probability of default

Modified (2003) Corporate Risk Weight Curve



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

"International Convergence of Capital Measurement and Capital Standards – A Revised Framework"

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)

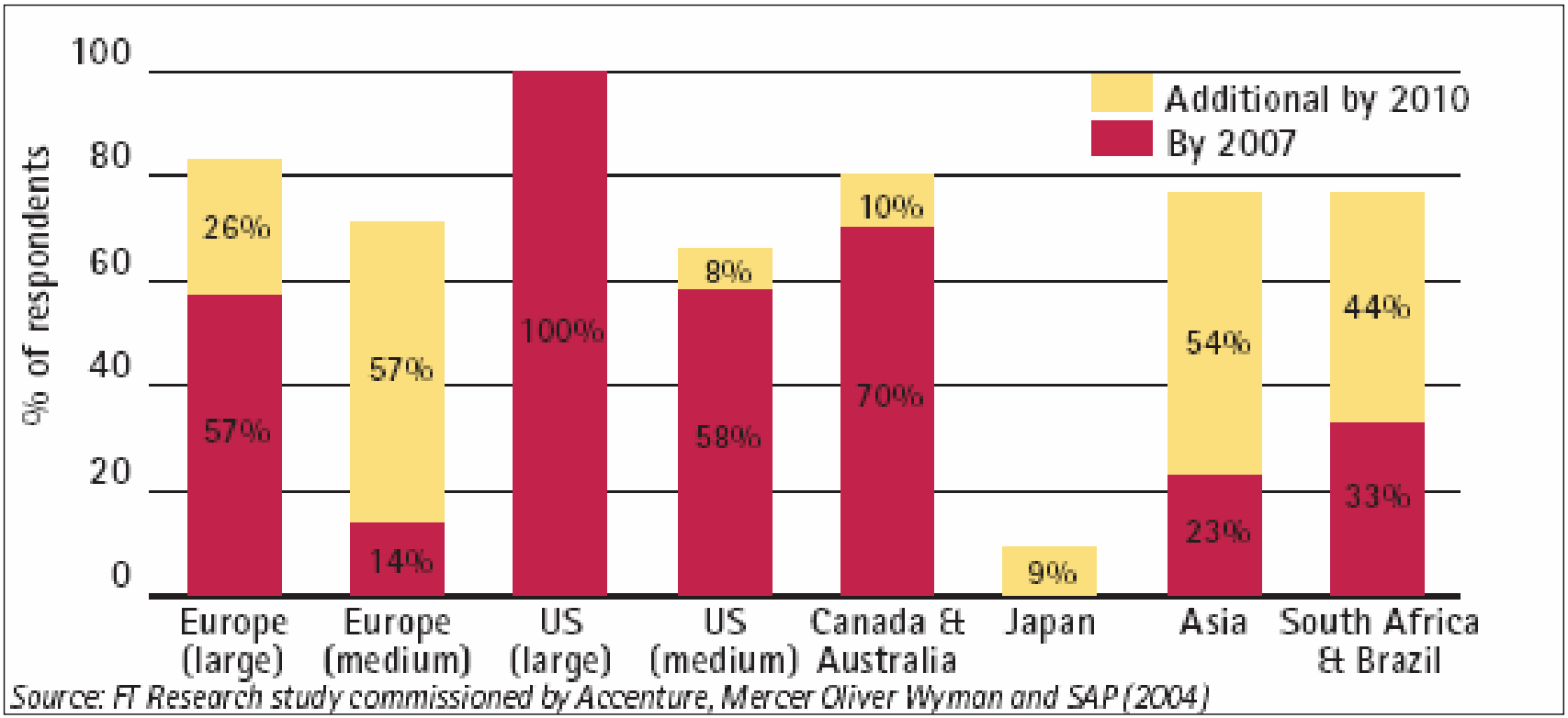
- European banks are substantially in advance of their US and Asian counterparts in the planning and testing of IRB systems. Also greater sponsorship from more senior executives of the banks.

- 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.

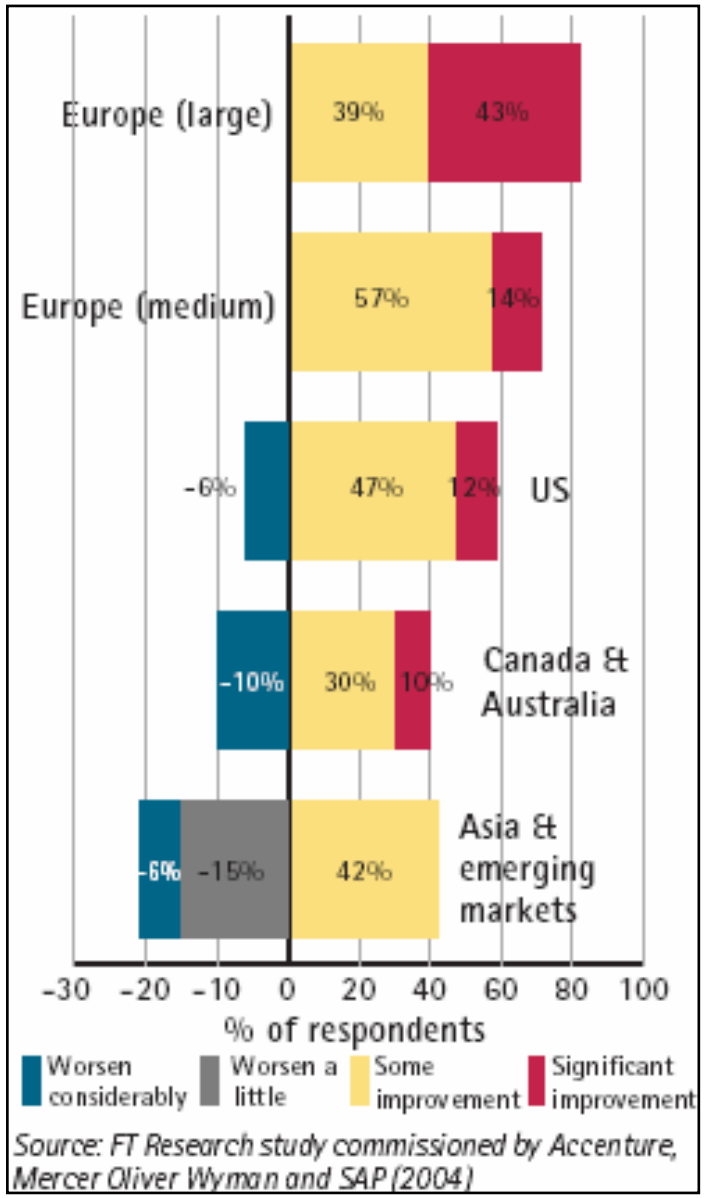
- Planned spending on Basel II, while still substantial, seems lower than earlier studies indicated (maximum use of centralized solutions where new systems are required).

Banks targeting IRB- Advanced



Source: FT Research study commissioned by Accenture, Mercer Oliver Wyman and SAP (2004)

Expected Change in Capital Position



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 x 1 –((S-5)/45)) made to corporate weighting formula (S=Annual Sales; 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.

Estimates on the Impact of Basel II on SMEs

- 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)

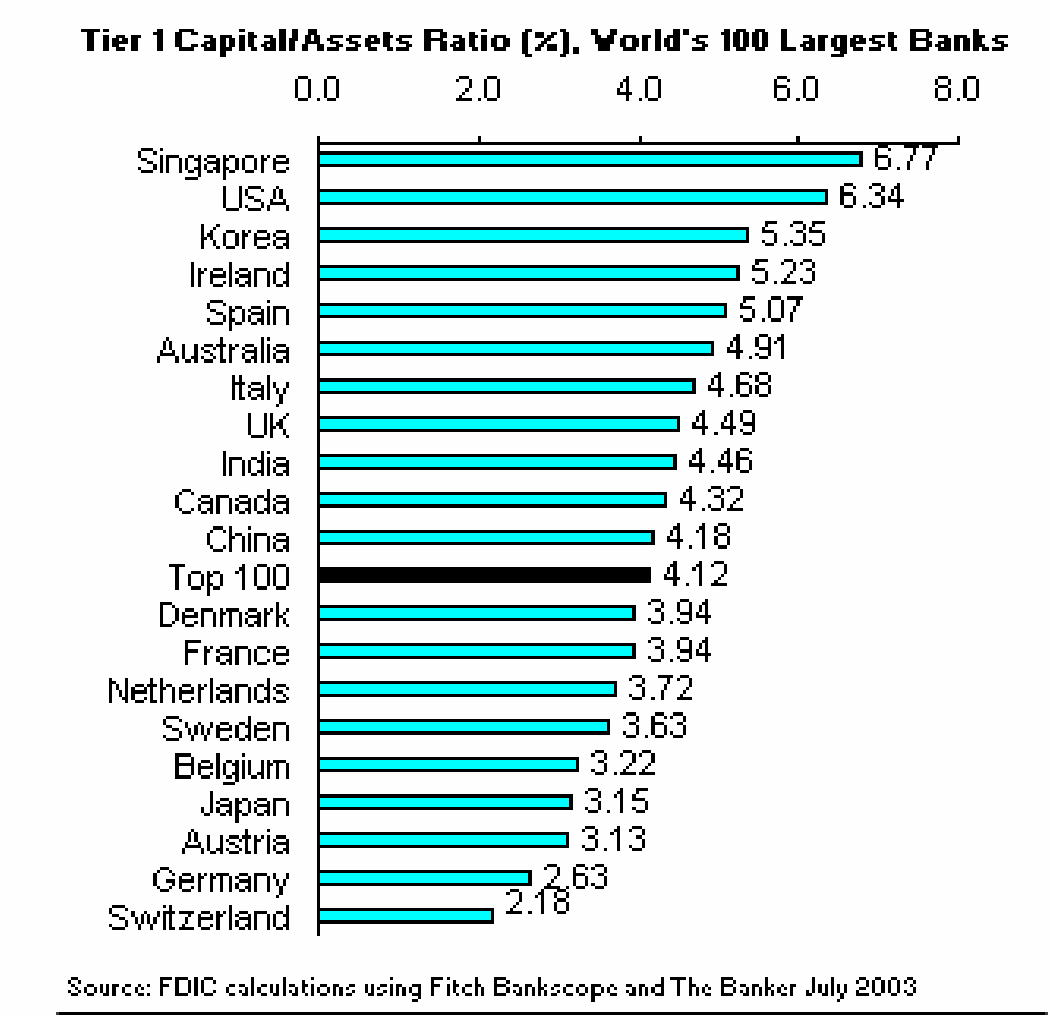
Portfolio	Group 1 Banks (%)		Group 2 Banks (%)	
	Standardized	IRB-Advanced	Standardized	IRB-Foundation
Retail (Including Small Firms)	-4.72	-8.65	-9.33	-22.46
Corporate SMEs	-1.23	-5.05	-2.23	-4.93
Corporate	0.22	-2.84	-0.74	-3.79
Operational Risk	8.08	9.67	9.41	6.36
Bank	1.61	-0.53	1.30	1.11
Other	4.52	3.65	0.37	-0.15
Total:	8.48%	-3.75%	-1.22%	-23.86%

Source: European Commission Report (2003)

Estimating the Capital Impact of Basel II in the United States

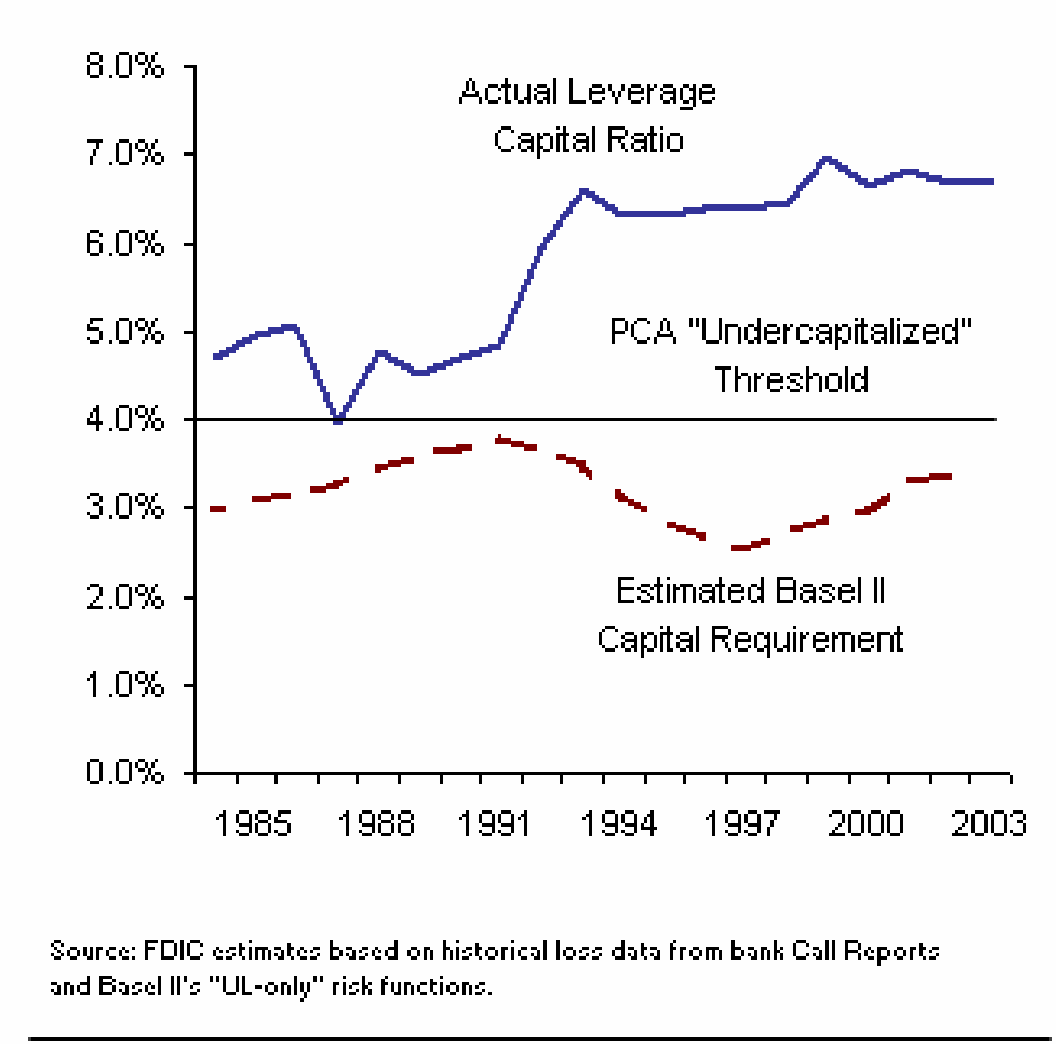
- A 2003 FDIC study estimates the capital impact of Basel II's advanced internal-ratings-based approach (A-IRB). Based on 19 years of financial data from all FDIC-insured commercial banks, the FDIC developed a range of values for the key Basel II risk parameters that banks might be expected to use over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



Source: FDIC report "Estimating the Capital Impact of Basel II in the United States", December 8, 2003.

Chart 2: Basel II Capital - Still Investment Grade?



Source: FDIC report "Estimating the Capital Impact of Basel II in the United States", December 8, 2003.

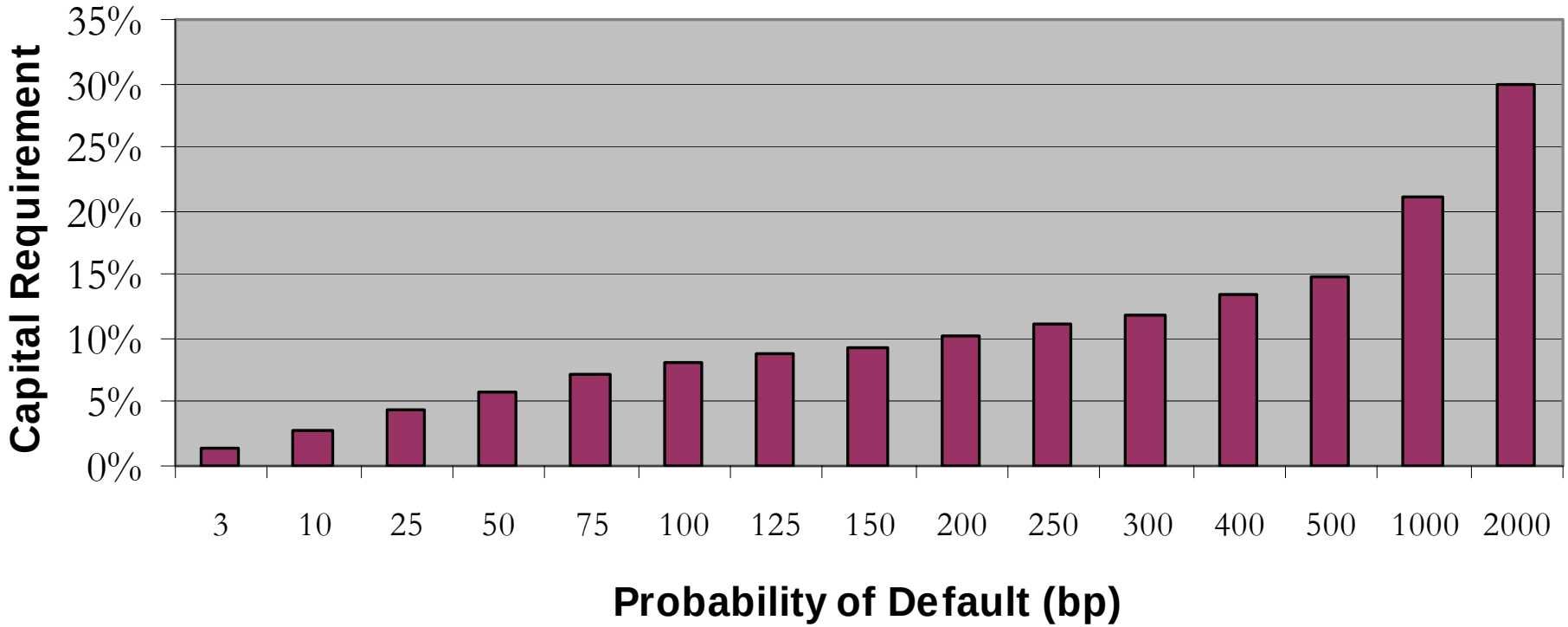
The Importance of Credit Ratings

- 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

PRIORITY: Map Internal Ratings to Public Rating Agencies

Internal Credit Ratings	Code	Meaning	Corresponding Moody's
1	A	Exceptional	Aaa
2	B	Excellent	Aa1
3	C	Strong	Aa2/Aa3
4	D	Good	A1/A2/A3
5	E	Satisfactory	Baa1/Baa2/Baa3
6	F	Adequate	Ba1
7	G	Watch List	Ba2/Ba3
8	H	Weak	B1
9	I	Substandard	B2/B3
10	L	Doubtful	Caa - O
	N	In Elimination	
	S	In Consolidation	
	Z	Pending Classification	

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

Credit Assessment of Sovereign	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Sovereign risk weights	0%	20%	50%	100%	150%	100%
Risk weights of banks	20%	50%	100%	100%	150%	100%

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

Credit Assessment of Banks	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Risk weights	20%	50%	50%	100%	150%	50%
Risk weights for short-term claims	20%	20%	20%	50%	150%	20%

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

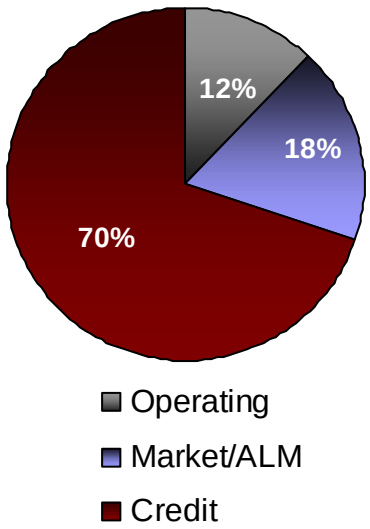
BIS Collateral Proposals (continued)

- 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



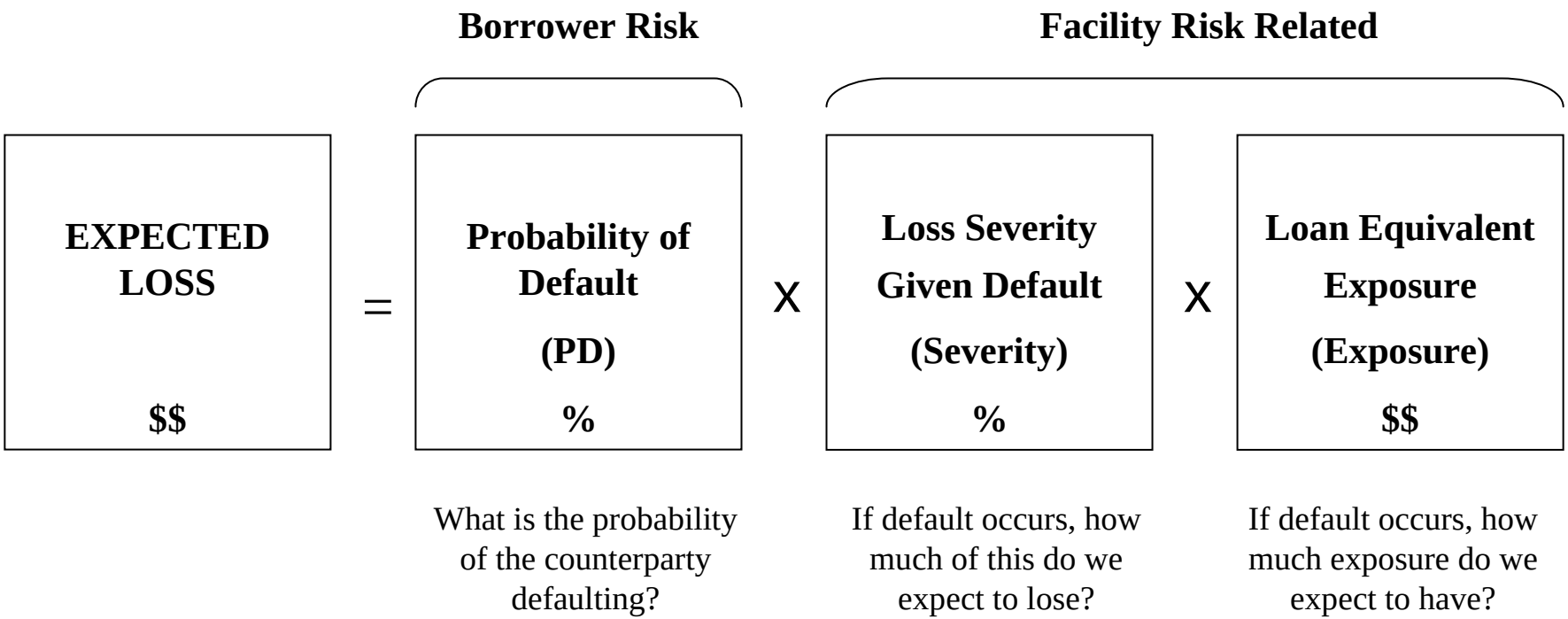
CREDIT RISK COMPONENTS

- Default Probability
- Default Severity
- Migration Probabilities

CREDIT RISK PARAMETERS

- **Scoring Models**
- Recovery Rates
- Transition Matrices

Expected Loss Can Be Broken Down Into Three Components



The focus of grading tools is on modeling PD

The Starting Point is Establishing a Universal Rating Equivalent Scale for the Classification of Risk

	CREDIT GRADES	RISK LEVEL	PD (bp)	S&P
Performing	1	Minimal	0-1	AAA
	2	Modest	2-4	AA
	3	Average	5-10	A
	4	Acceptable	11-50	BBB
	5	Acceptable with care	51-200	BB
	6	Management Attention	201-1000	B
Substandard	7	Special Mention	1000+	CCC
	8	Substandard	Interest Suspense	CCC / CC
	9	Doubtful	Provision	CC / C
	10	Loss	Default / Loss	D

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)

$$Z = 1.2\ X_1 + 1.4\ X_2 + 3.3\ X_3 + 0.6\ X_4 + 1.0\ X_5$$

X_1 = working capital / total assets

X_2 = retained earnings / total assets

X_3 = earning before interest and taxes / total assets

X_4 = market value of equity / book value of total liabilities

X_5 = sales / total assets

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

Financial Factors	***Non-financial Factors***
Debt service coverage	Size
Leverage	Industry
Profitability	Age / experience of key managers
Liquidity	ALM
Net worth	Location

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”)

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

	Predicted Negatives	***Predicted Positives***
Actual Negatives	True Negatives	False Positives (type I error)
Actual Positives	False Negatives (type II error)	True Positive

- 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

SUPERVISOR	BANK
Capital Adequacy "Enough Capital"	Capital Efficiency "Capital Deployed Efficiently"

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

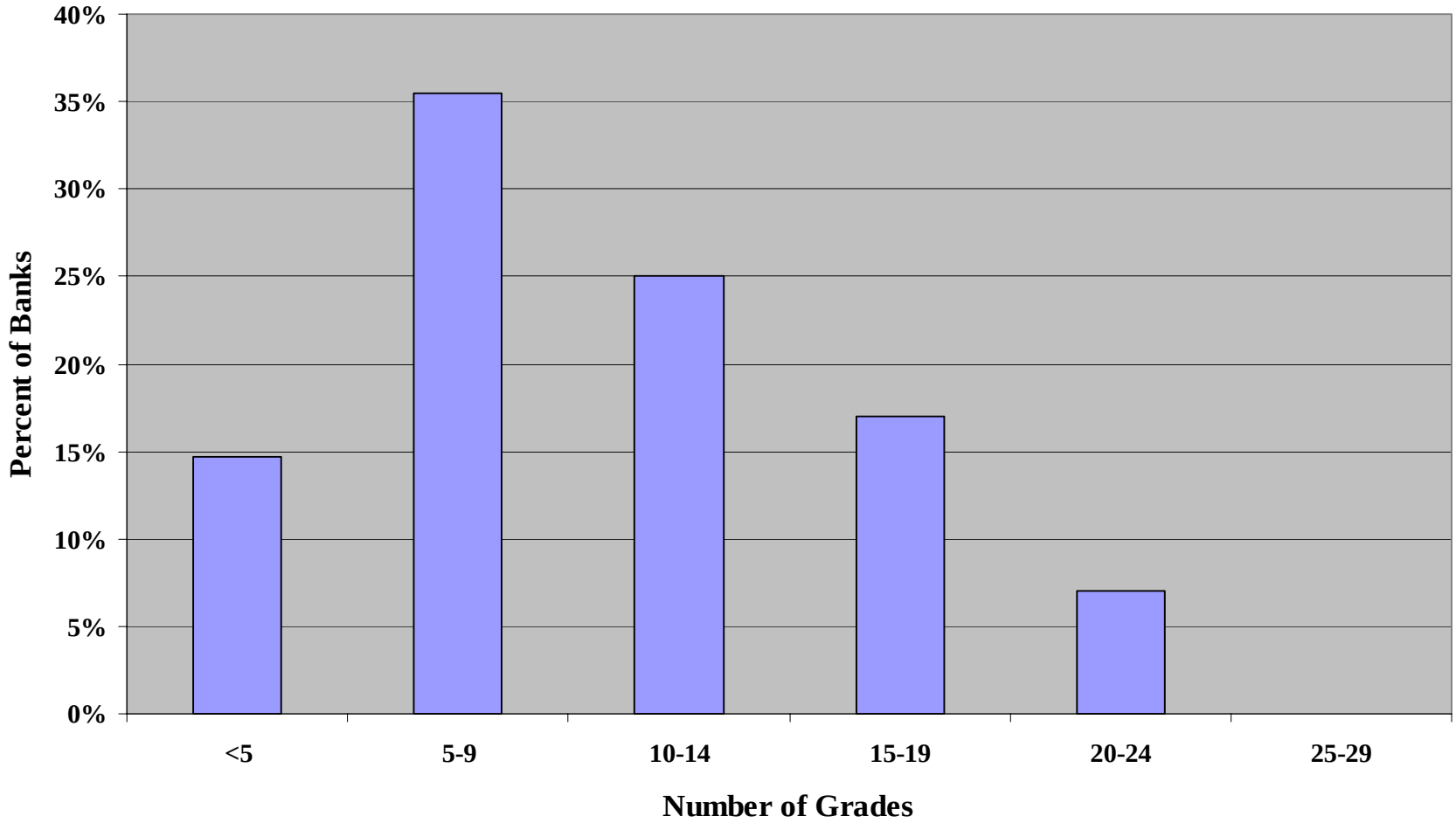
or

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

or

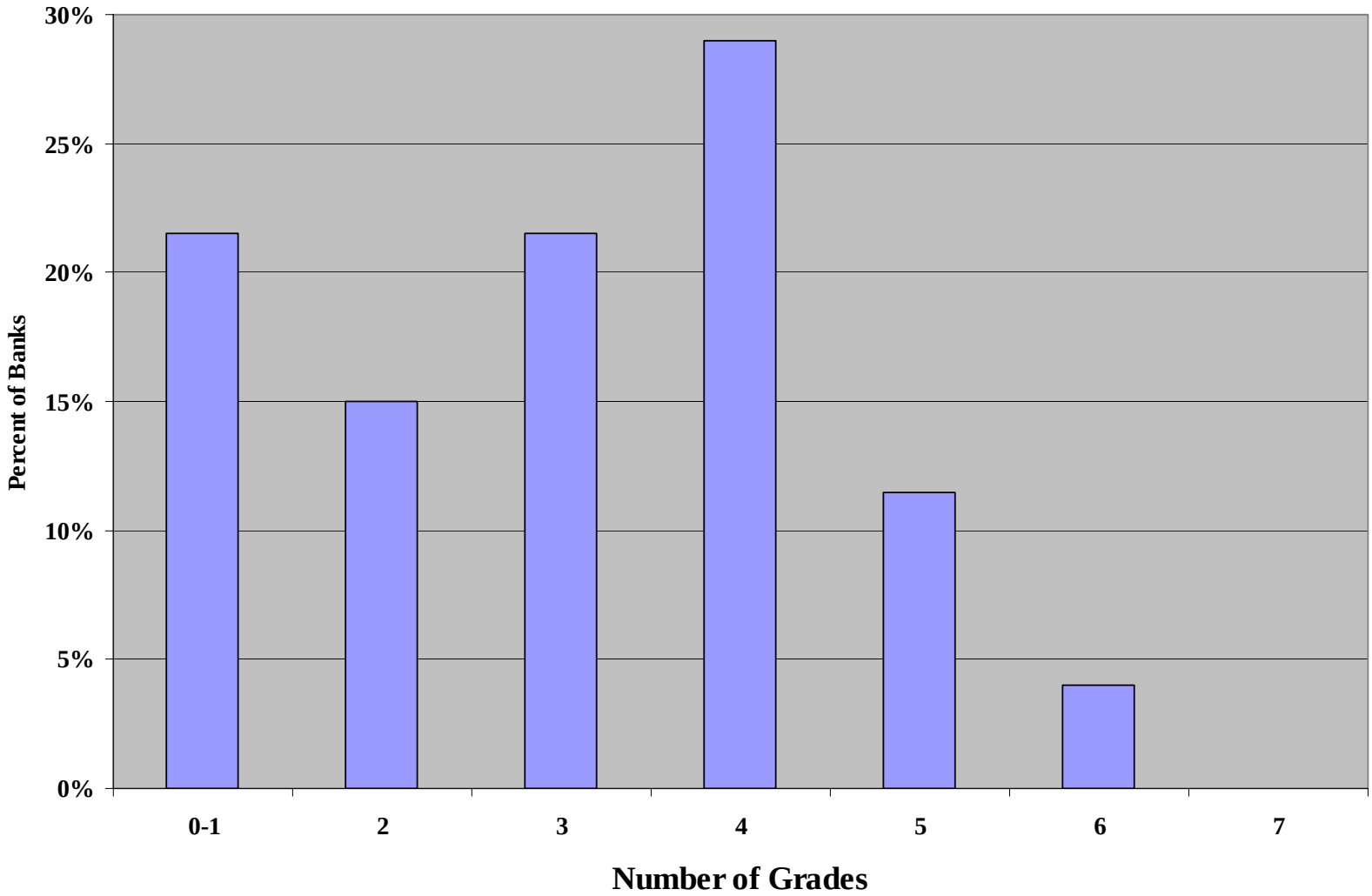
(c) **Advanced Management Approach** which uses the bank's own internal models of operational risk measurement to assess a capital requirement

Number of Non-Impaired Grades



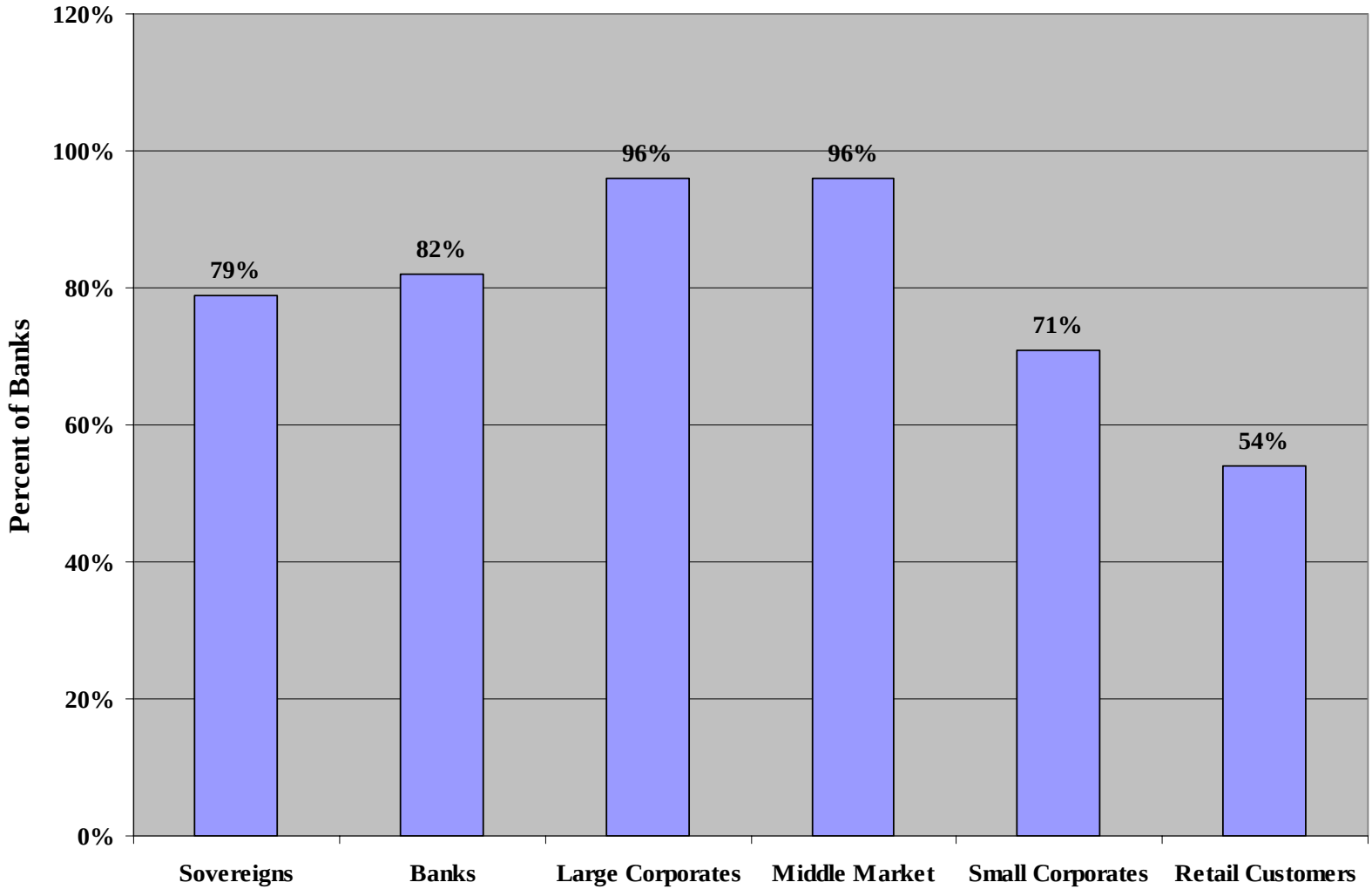
Source: "Range of Practice in Banks' Internal Rating Systems," Discussion Paper, Basel Committee on Banking Supervision, January 2000.

Number of Impaired Grades



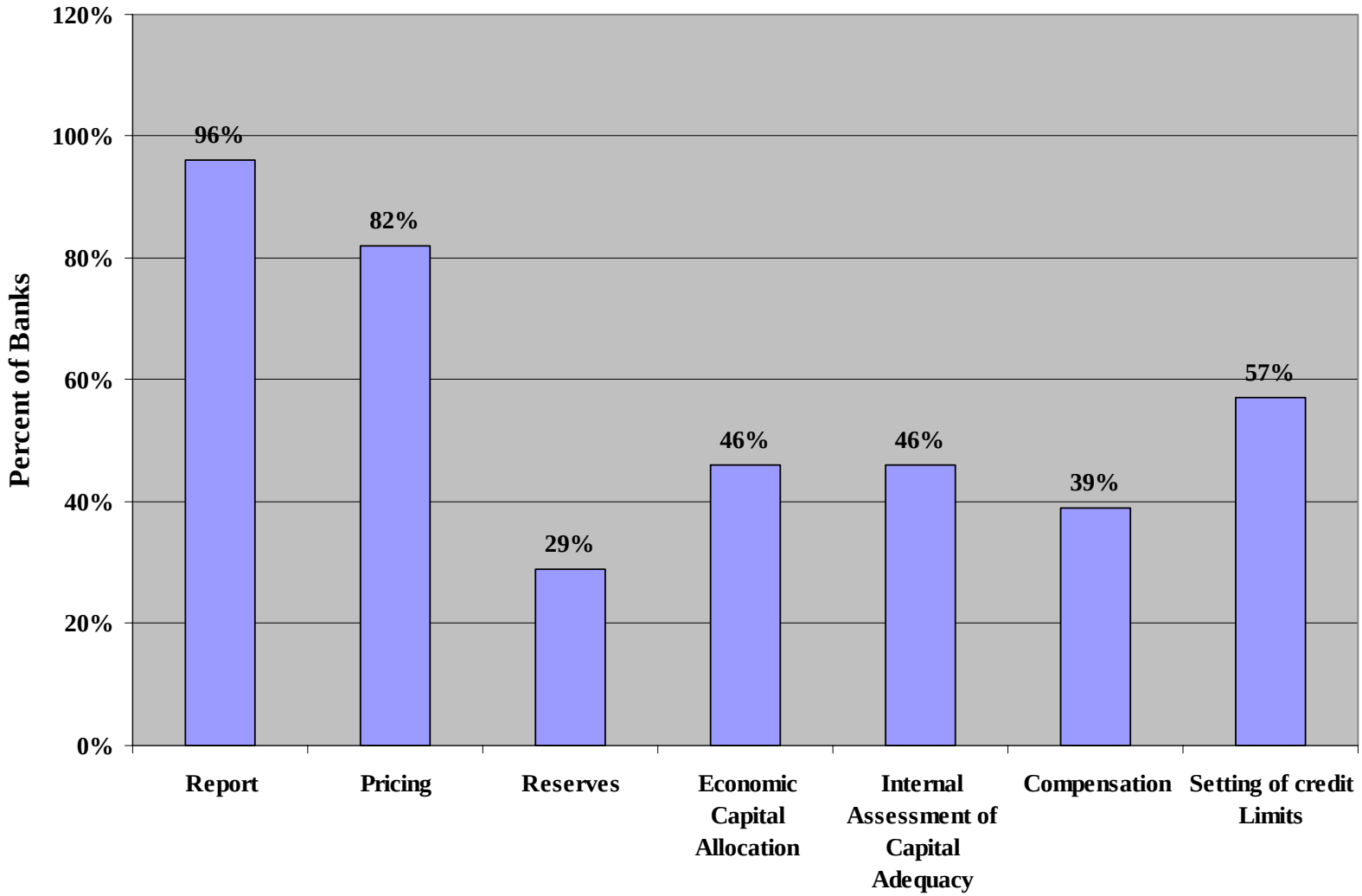
Source: "Range of Practice in Banks' Internal Rating Systems," Discussion Paper, Basel Committee on Banking Supervision, January 2000.

Rating Coverage



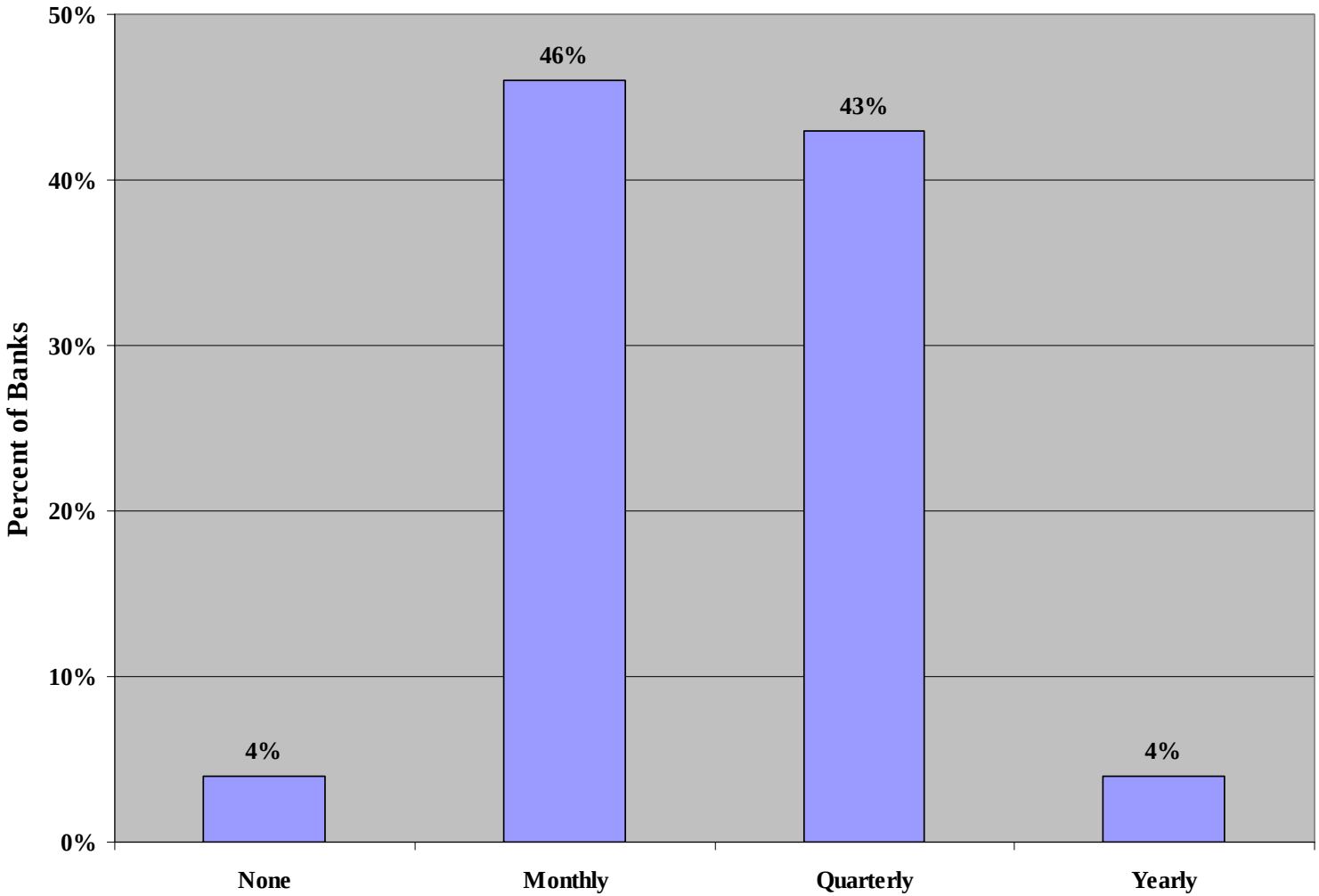
Source: "Range of Practice in Banks' Internal Rating Systems," Discussion Paper, Basel Committee on Banking Supervision, January 2000.

Rating Usage



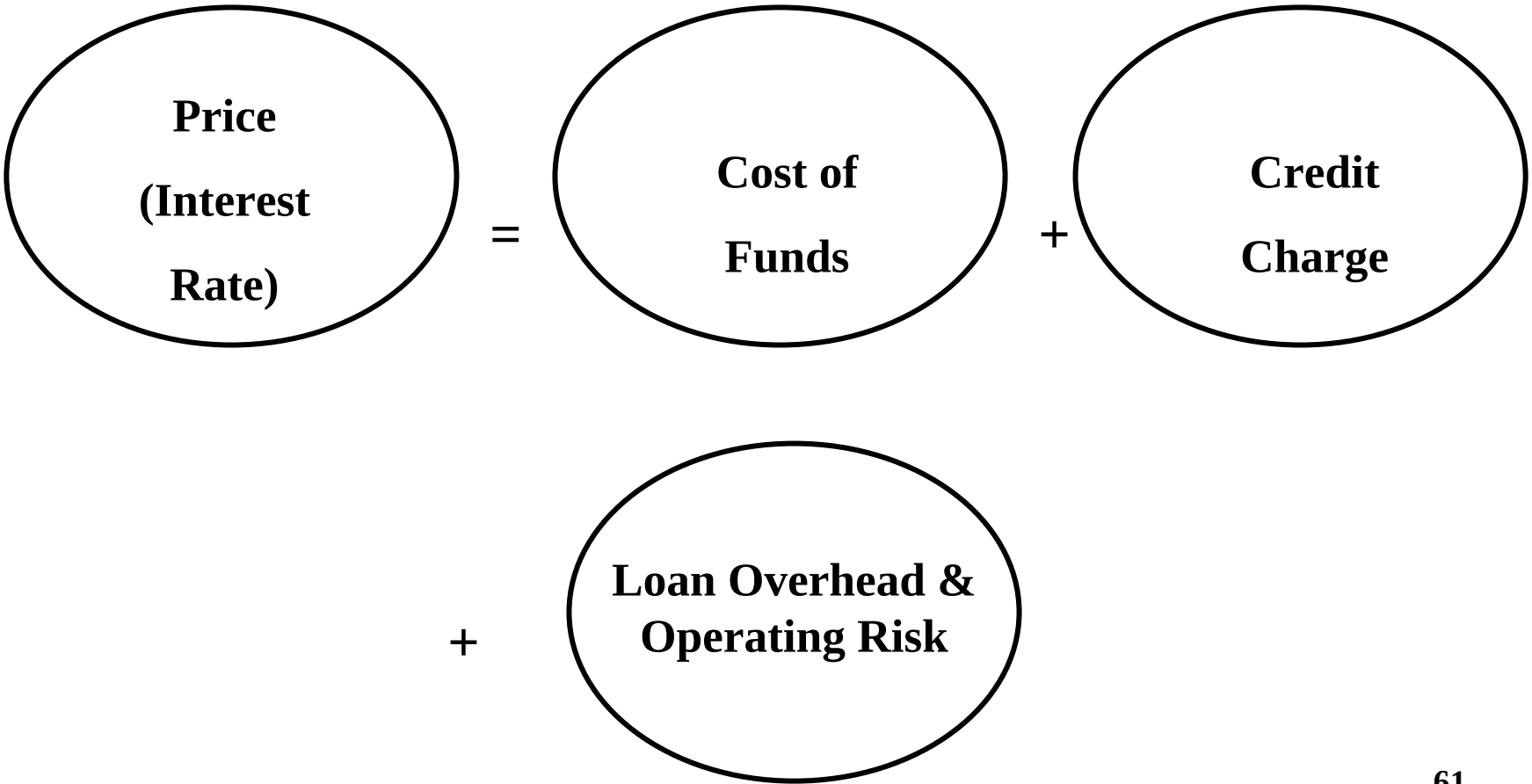
Source: "Range of Practice in Banks' Internal Rating Systems," Discussion Paper, Basel Committee on Banking Supervision, January 2000.

Calculation of Internal Capital Estimates

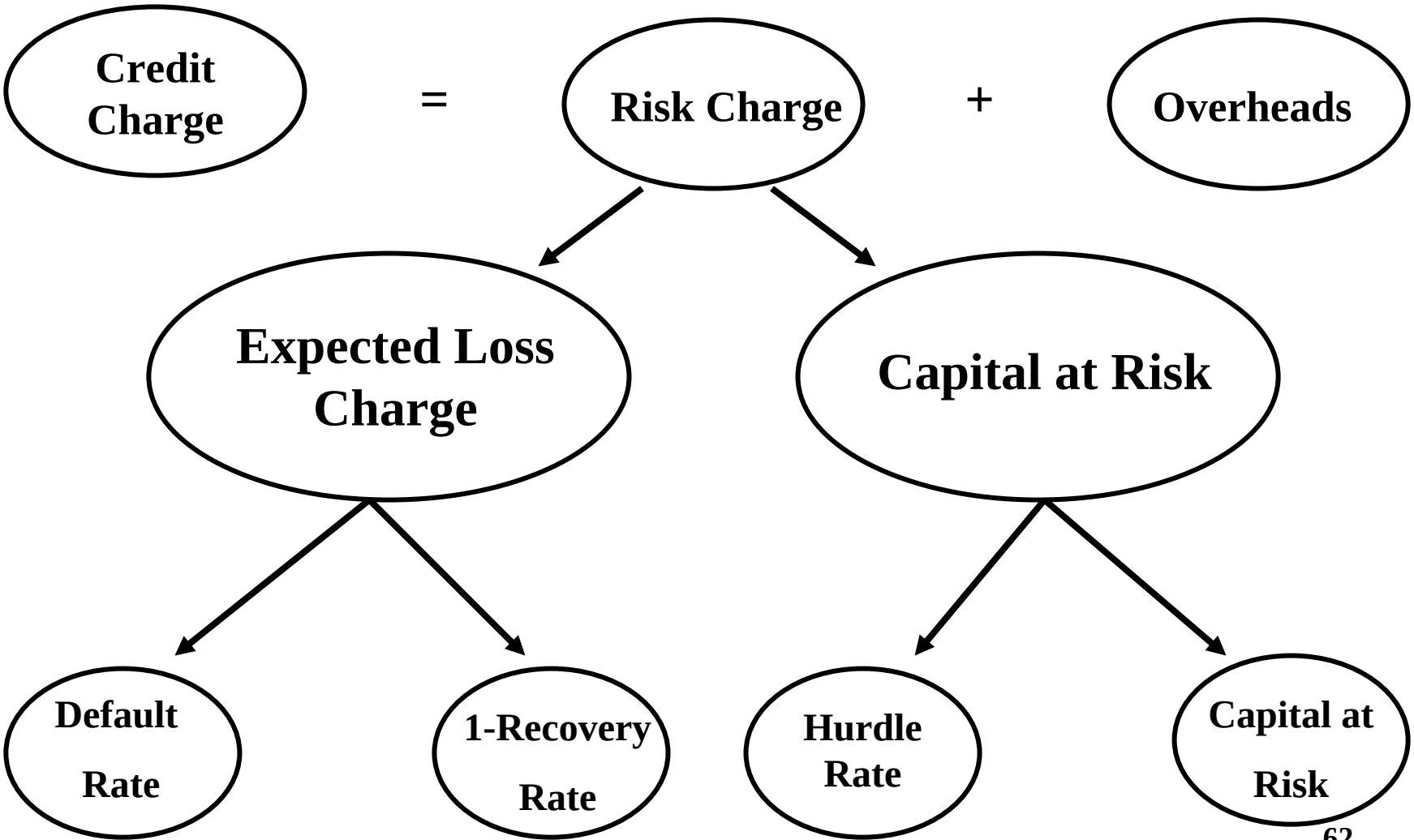


Source: "Range of Practice in Banks' Internal Rating Systems," Discussion Paper, Basel Committee on Banking Supervision, January 2000.

Risk Based Pricing Framework



Proposed Credit Risk Pricing Model



An Alternative Structure For Estimating Expected Loss

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

where:

$P_{D,R}$ = Probability of Default in Credit Rating Class R

EXP = Exposure of Loan Facility

CRV = Collateral Recovery Value on Loan Facility

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% x [1-.7]) + (6 [0.5%] x 15%) + 0.4% = 6.94%

Or

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

(1) Internal Model for Capital Allocation
(2) BIS Capital Allocation method

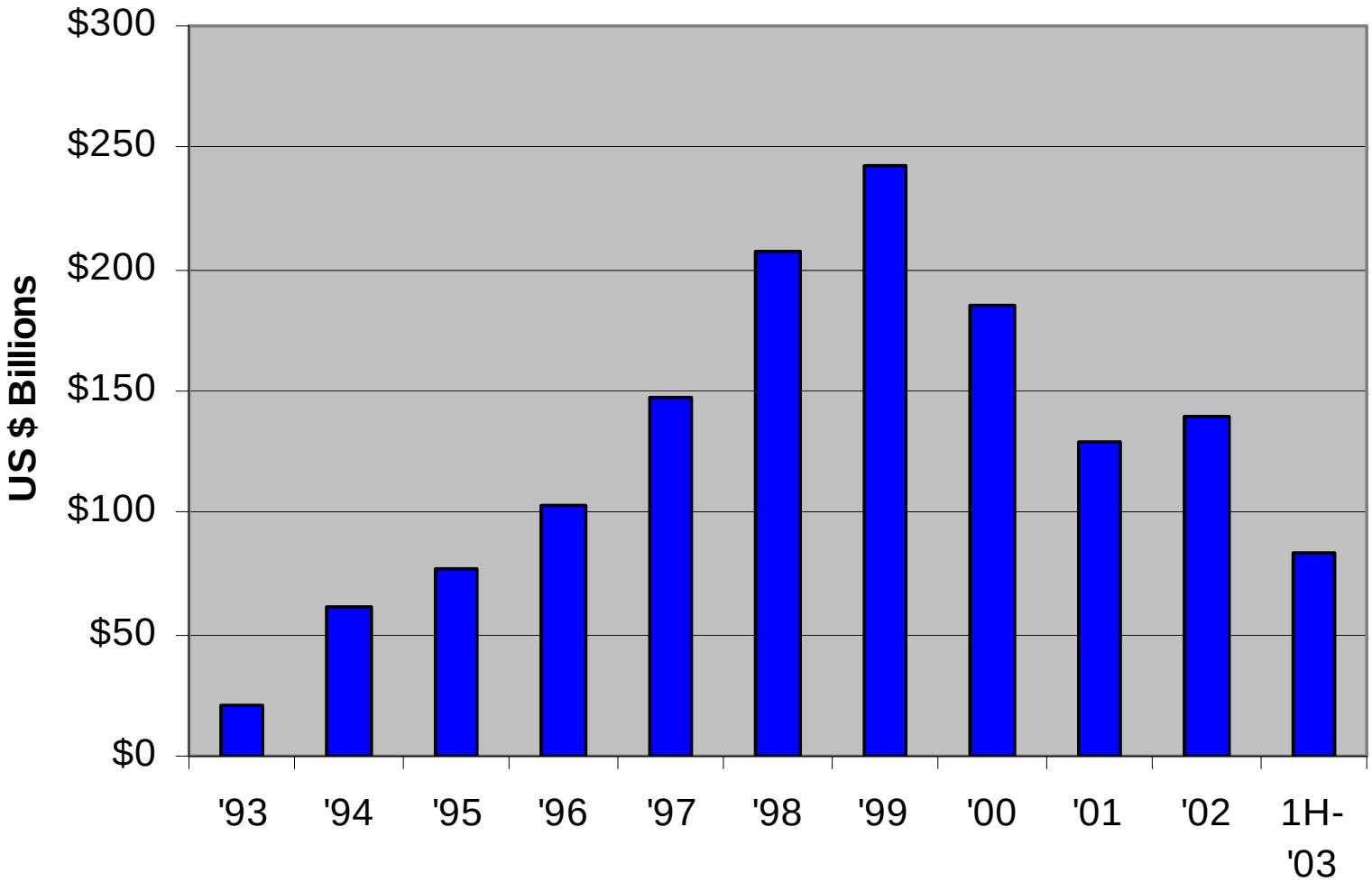
Bank Loans Vs. Bonds*

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

	Bank Loans	Bonds
Claim on Assets	**Senior**	**Subordinated**
Collateral	**Secured**	**Mostly Unsecured**
Rate	**Floating**	**Fixed**
Principal Repayment	**Amortizing**	**At Call or Maturity**
Covenant Package	**Restrictive**	**Less Restrictive**
Mandatory Prepayments	**In Most Cases**	**Some Cases**

** Typical Structures*

New-Issue Leveraged Loan Volume in US Dollars*



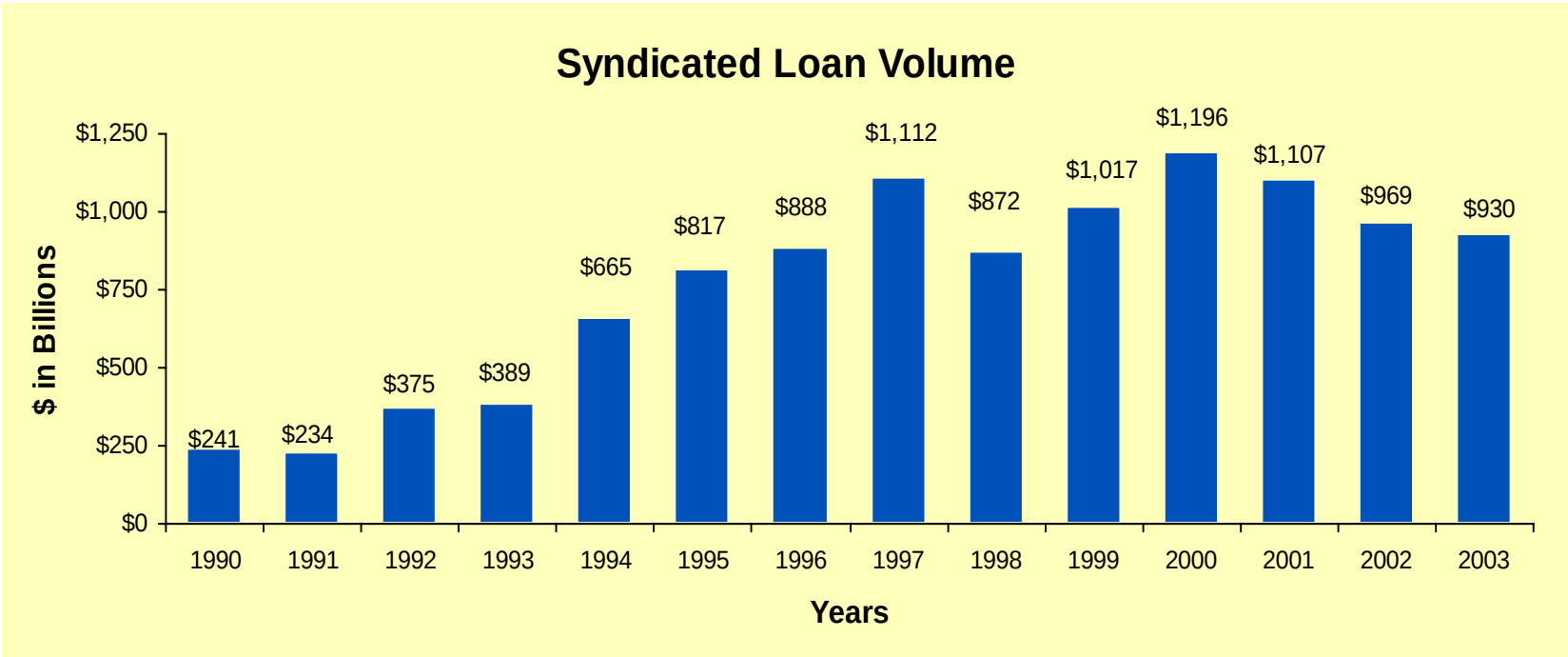
Source: S&P, Loan Pricing Corporation

*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

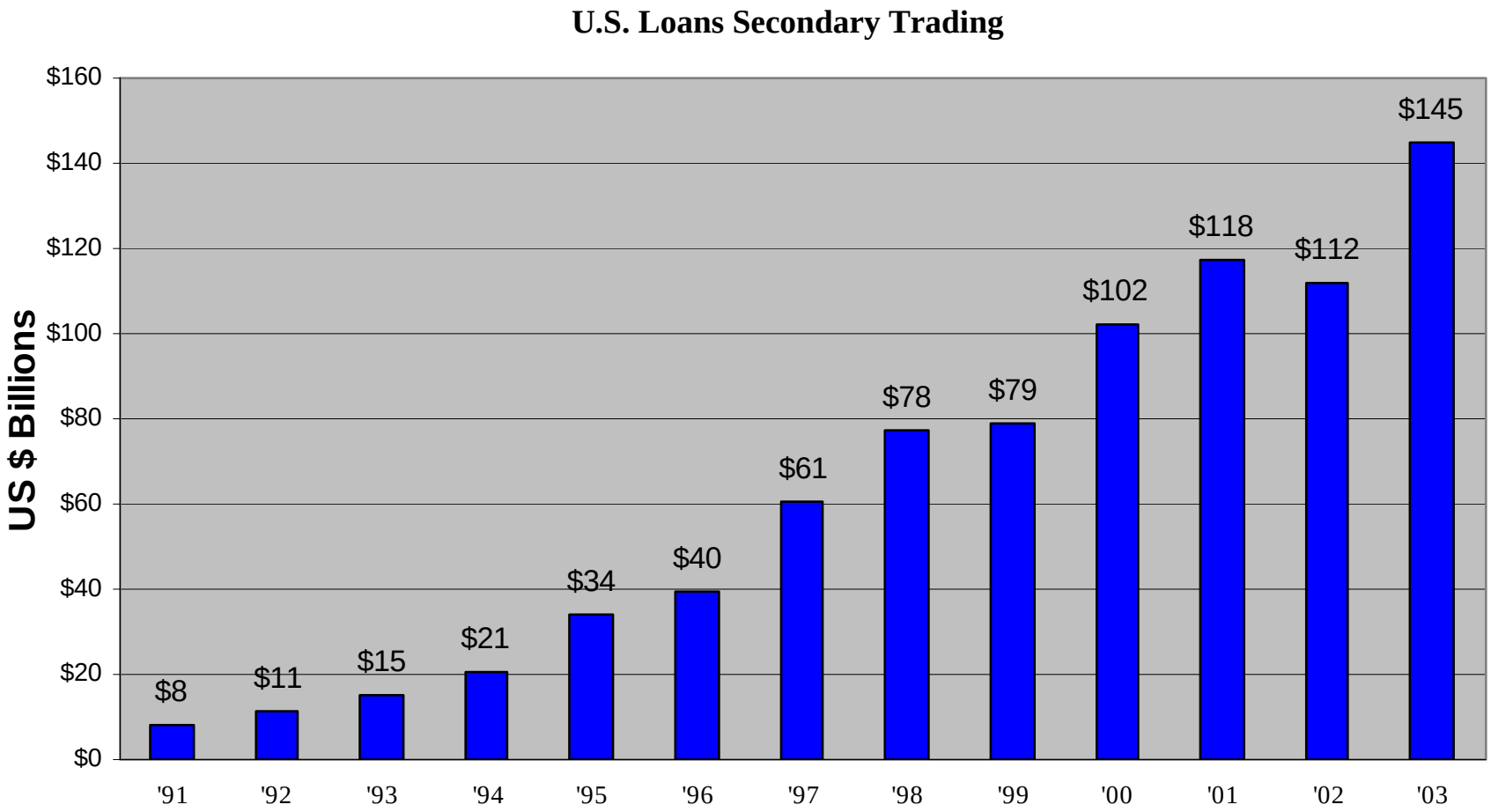
Over this period, credit markets have evolved beyond recognition

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



Data Source: LPC (US)

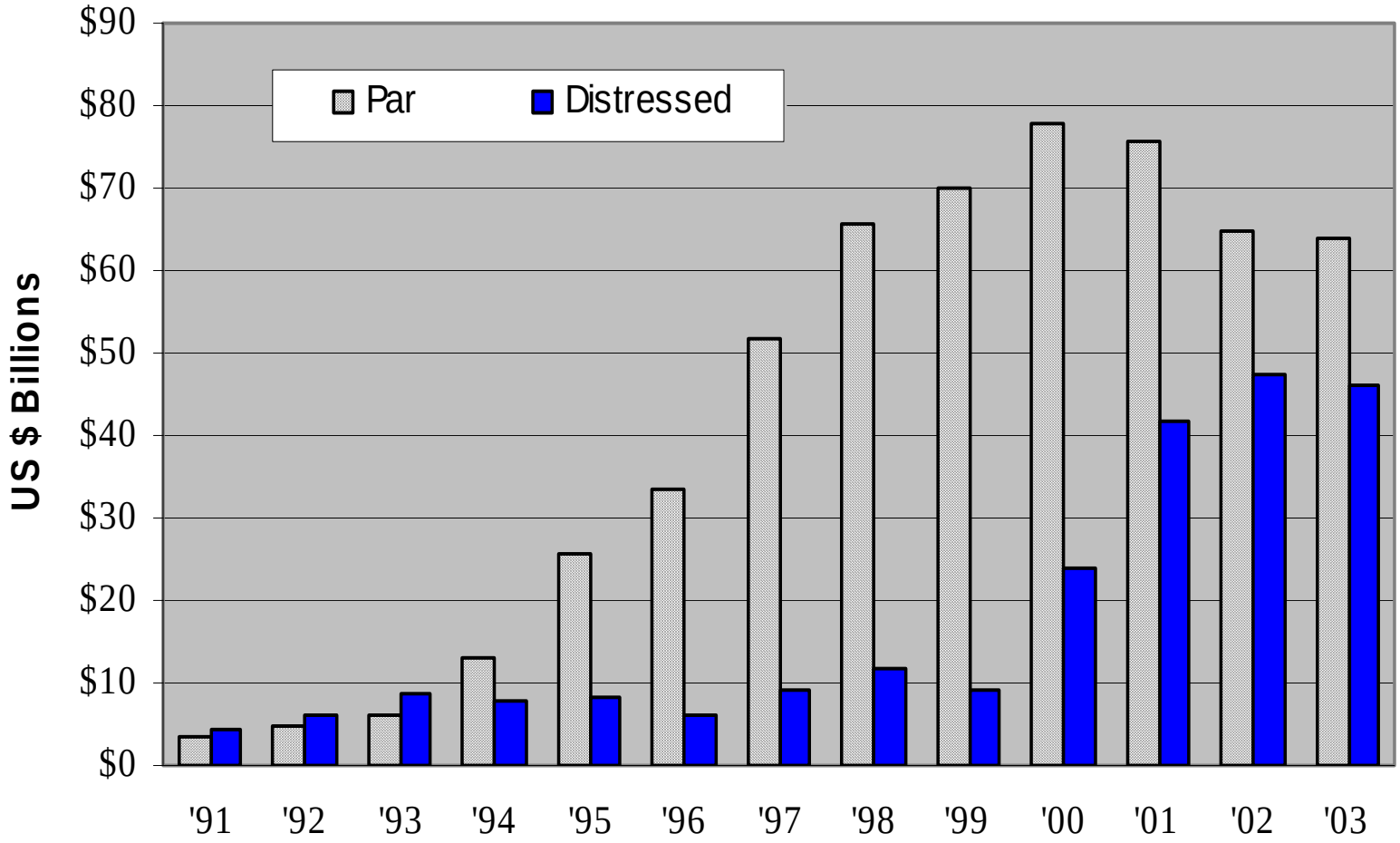
Secondary Loan Trading Volume



Source: S&P, Loan Pricing Corporation

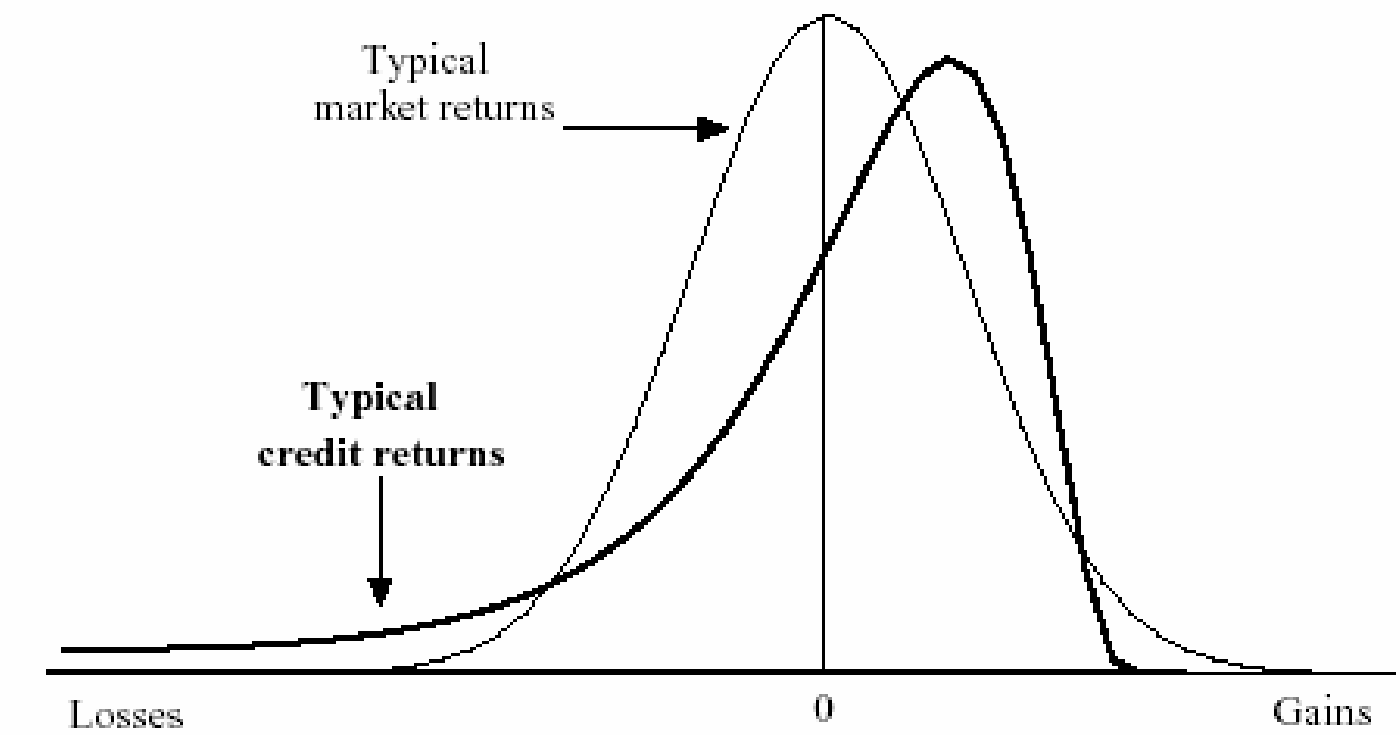
*Commercial loans with spreads of LIBOR + 150 bps or more

Secondary Loan Trading Volume - Par Vs. Distressed



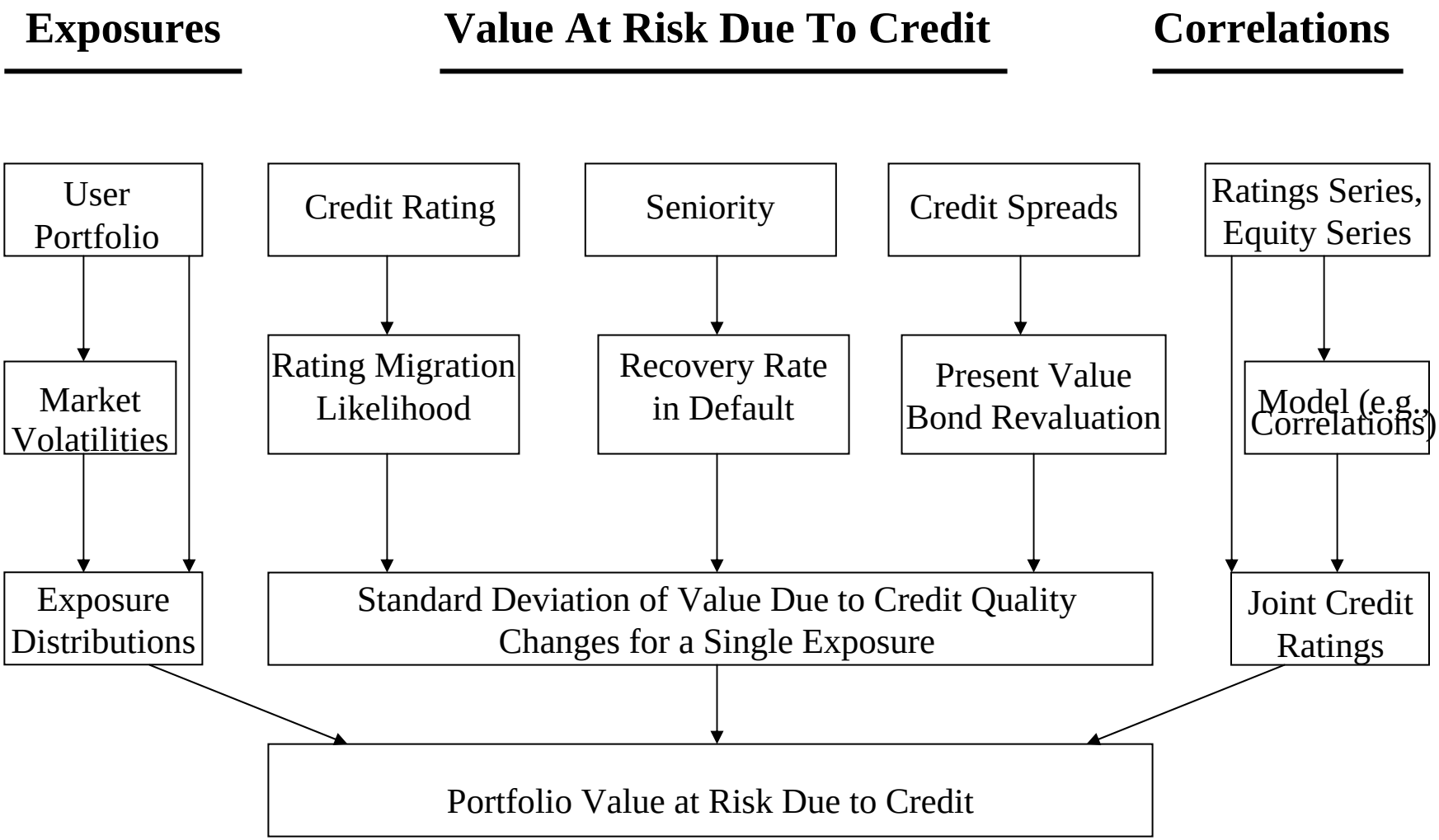
Source: Loan Pricing Corp.

Comparison of Distribution of Credit Returns and Market Returns



Source: CreditMetrics Technical Document

CreditMetrics™ Framework

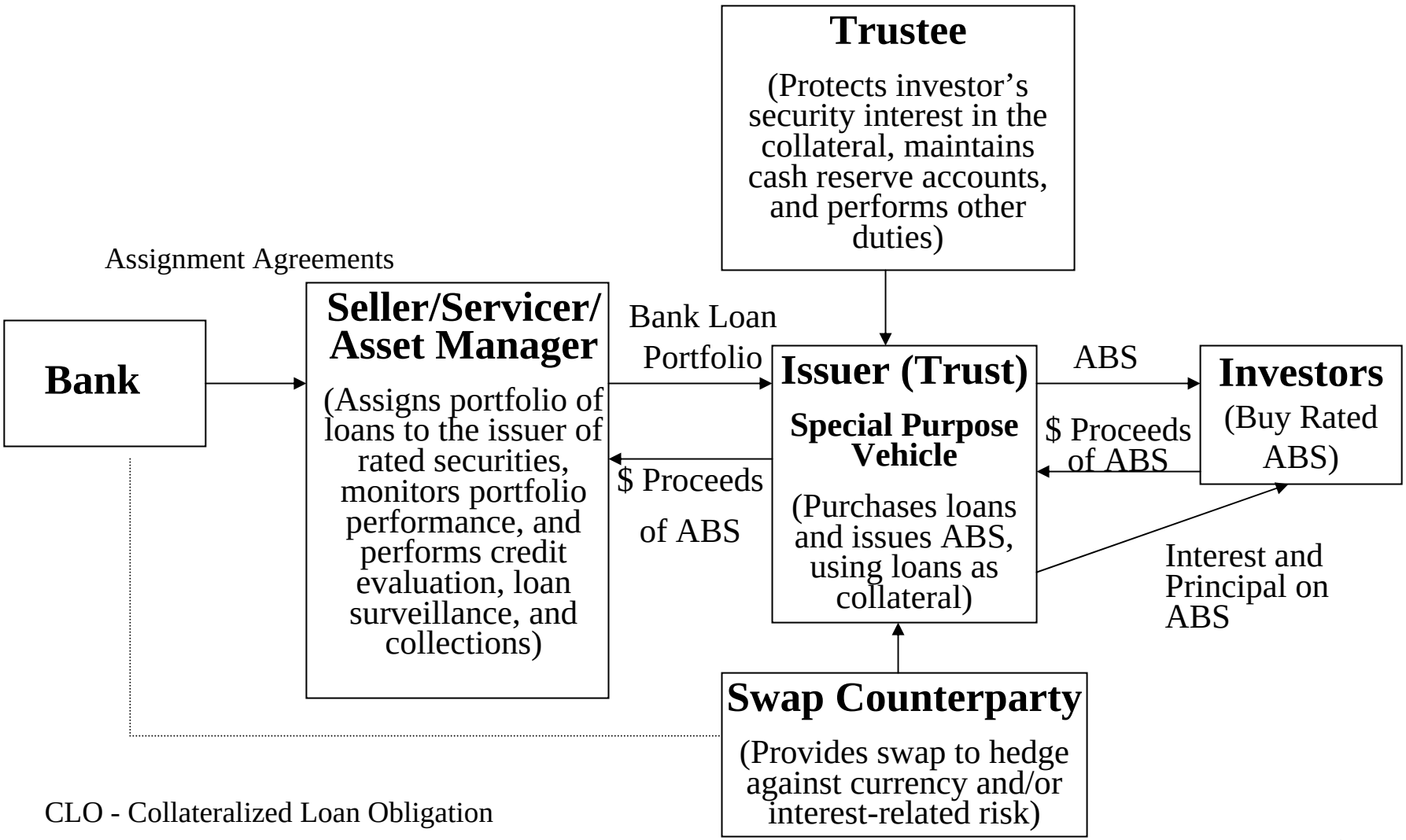


Source: J.P. Morgan, 1997

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



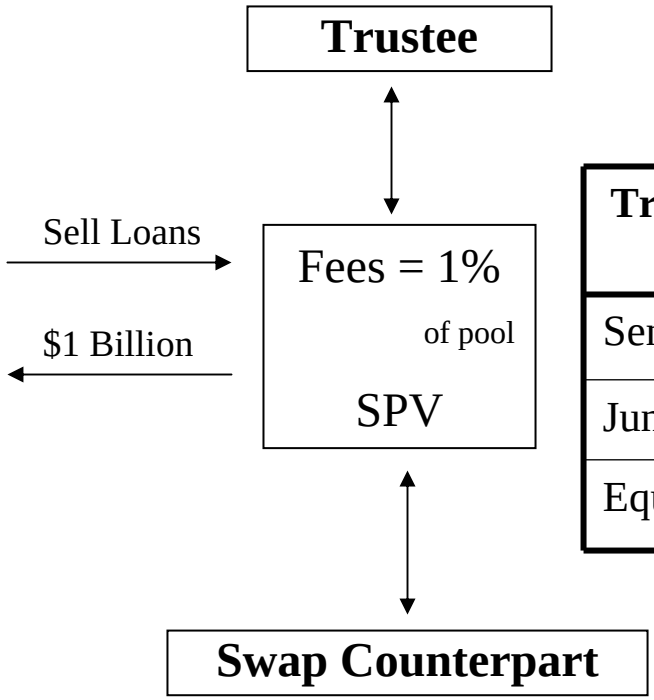
CLO - Collateralized Loan Obligation

ABS - Asset-backed Securities

CLO Example

Pool of Loans From Bank

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



Asset Backed Securities

Tranche	Size (%)	i	Rating
Senior	70%	.08	AA
Junior	20%	.11	BB
Equity	10%	-	-

CLO Example

Returns with No Defaults: Returns to ABS

		First Year	*Second Year*
Total Interest	=	$100 million	$100 million
Interest to Senior	=	$56 million	$56 million
Fees	=	$10 million	--------
Net From Jr.		$34 million	$44 million
Interest to Jr.	=	$22 million	$22 million
Net to Equity	=	$12 million	$22 million
ROE	=	???	???

Growth in the Credit Derivative Market (Notional Amounts)

	1997	1998	1999	2000	2001	2002	2003	2004
US$ Billions	180	350	590	890	1,200	2,300	3,600*	5,100*

*Source: Risk, February 2003 (*estimated)*

Credit Derivative Products

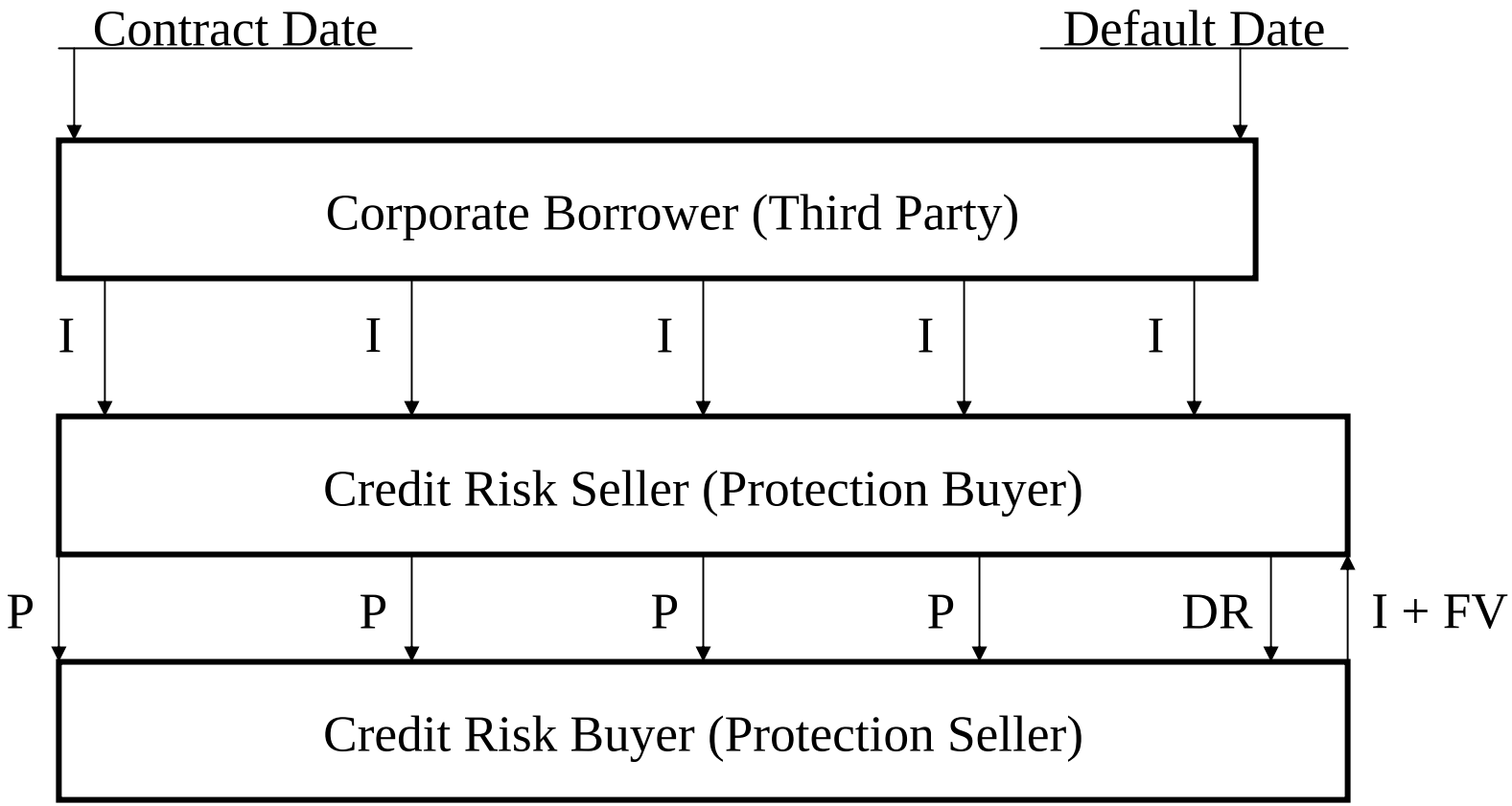
Structures

- Total Return Swap
- Default Contingent Forward
- Credit Swap
- Credit Linked Note
- Spread Forward
- Spread Option

Underlying Assets

- Corporate Loans
- Corporate Bonds
- Sovereign Bonds/Loans
- Specified Loans or Bonds
- Portfolio of Loans or Bonds

Credit Risk Derivative Contract Time Line



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)

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

*Source: Risk, February 2003 (*estimated)*

CDS Market Indexes

- **TRAC-X** (from Morgan Stanley/J.P.Morgan)
  - Created to represent regional CDS markets (eg. 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