Financial Risk Management in the Financial Markets

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I. Introduction

Why do Financial Institutions try to Manage Risk ?

Introduction

Global trends are leading to …

- The rising importance of risk management In financial institutions
- More complex markets
  - **Global markets**
  - **Greater product Complexity**
  - **New businesses (e-banking, merchant banking,…)**
  - **Increasing competition**
  - **New players**
  - **Regulatory imbalances**

Increased Risk

Introduction

- In the Distant Past . . .
  - **Institutions disaggregated their risks, and**
  - **treated each one separately.**

- However, today this approach is limited due to increasing
  - **Linkages between markets**
  - **Importance of calculating portfolio effects, e.g issuer and counterparty risks, credit spread equity risks, etc.**

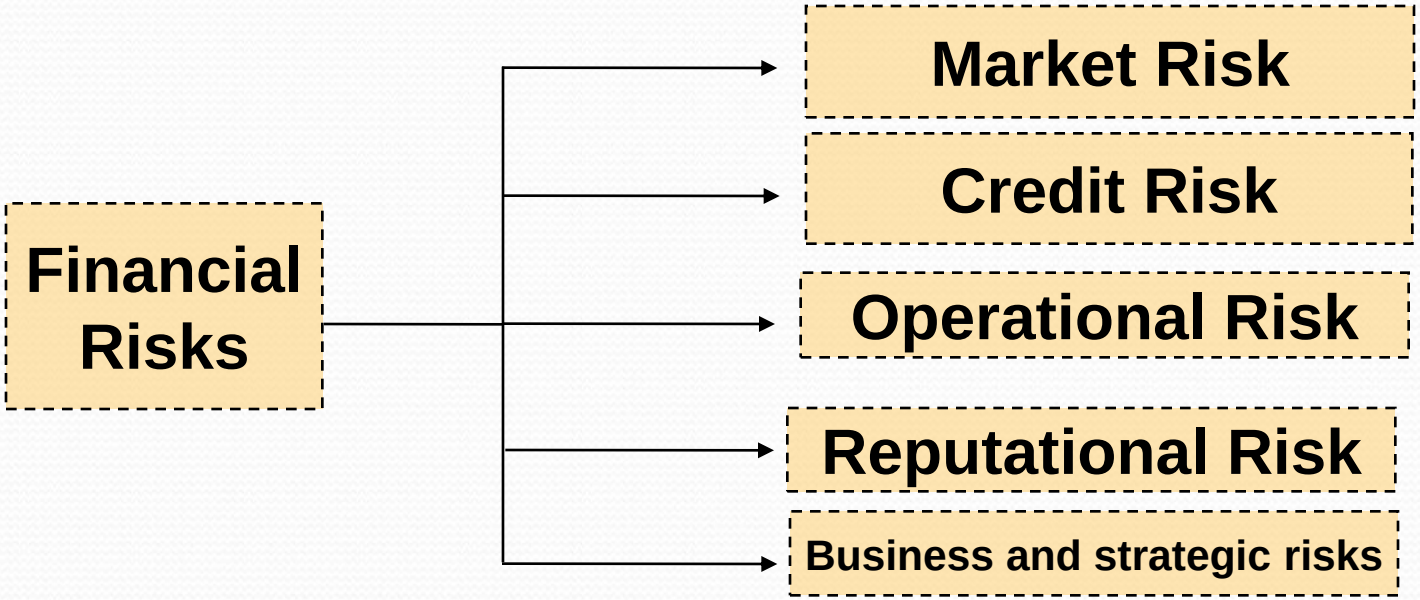
Introduction

- **In the future . . .**

> The leading institutions will be distinguished by their intelligent management of risk.

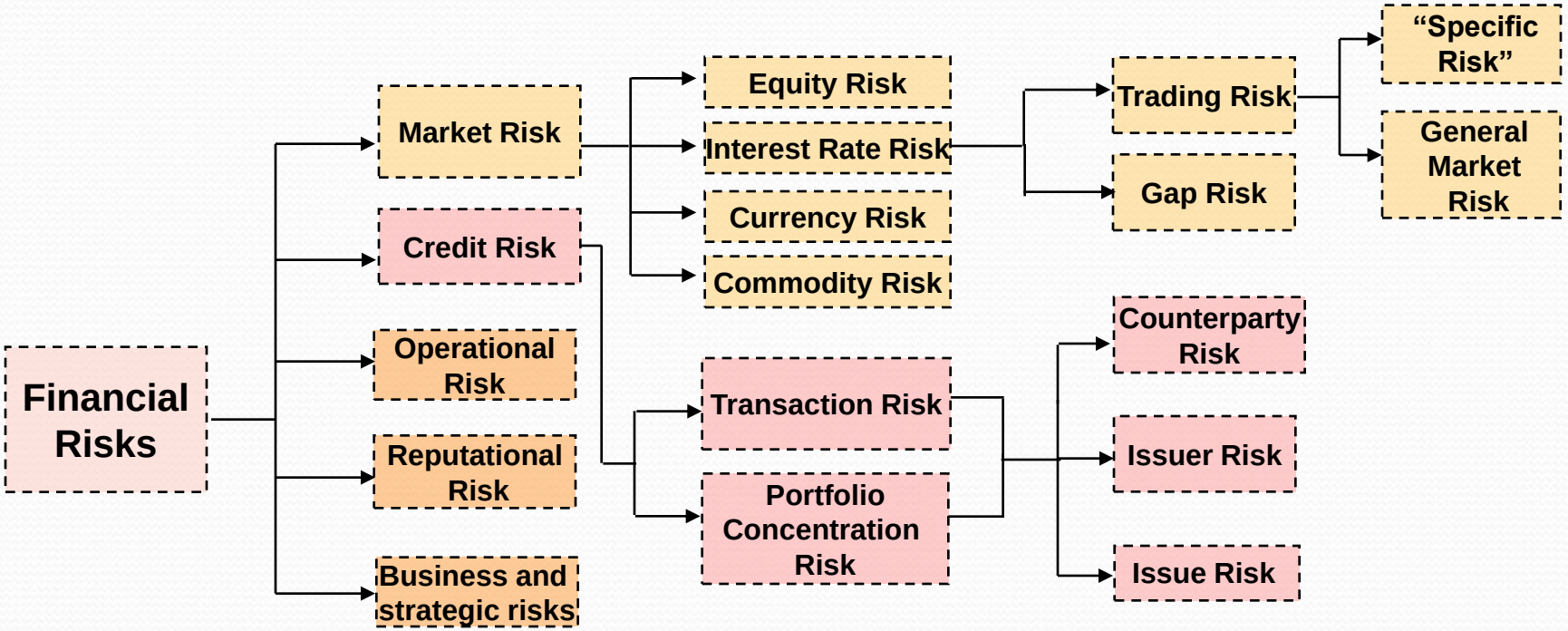
Introduction

- Risk is multidimensional



Introduction

- One can "slice and dice" these multiple dimensions of risk*



* For more details, see Chapter-1, "Risk Management" by Crouhy, Galai and Mark

II.

Best Practice Risk Management*

* For more details, see Chapter-3, “Risk Management” by Crouhy, Galai and Mark

Best Practice Risk Management

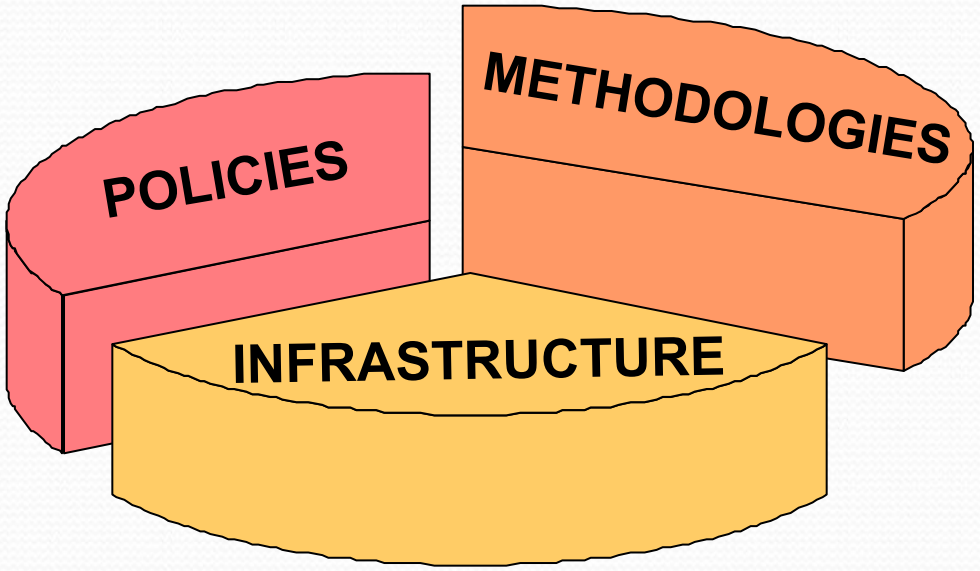
- Goal: Independence and Partnership

Establish a first class risk management function which is independent of the direct risk takers but works in partnership with them

Best Practice Risk Management

- Framework for Risk Management can be benchmarked in terms of:

  - **Policies**
  - **Methodologies**
  - **Infrastructure**



Best Practice Risk Management

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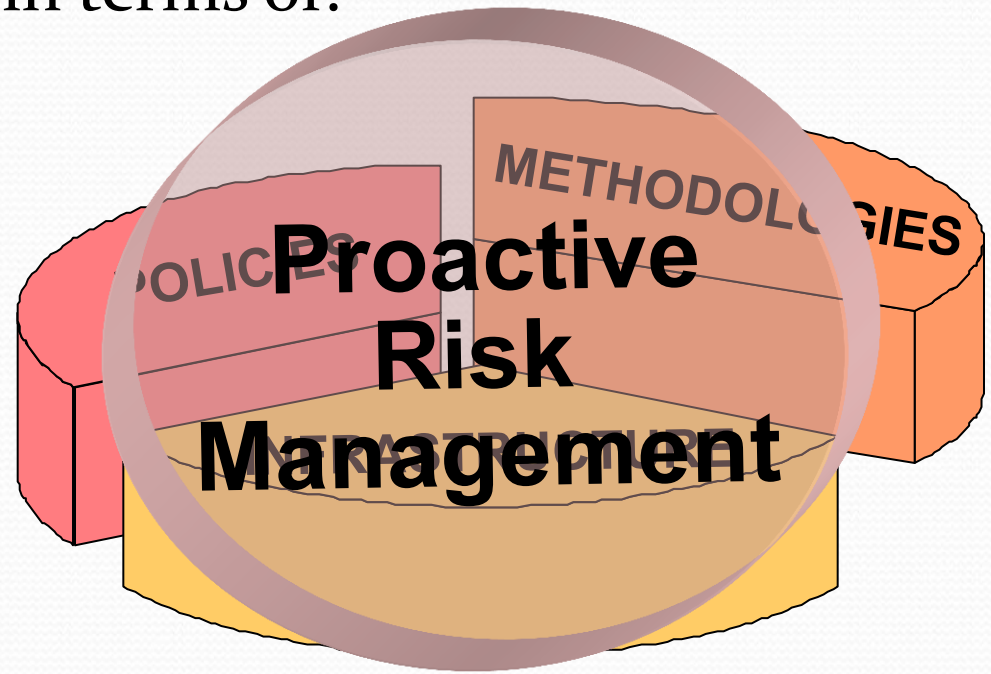
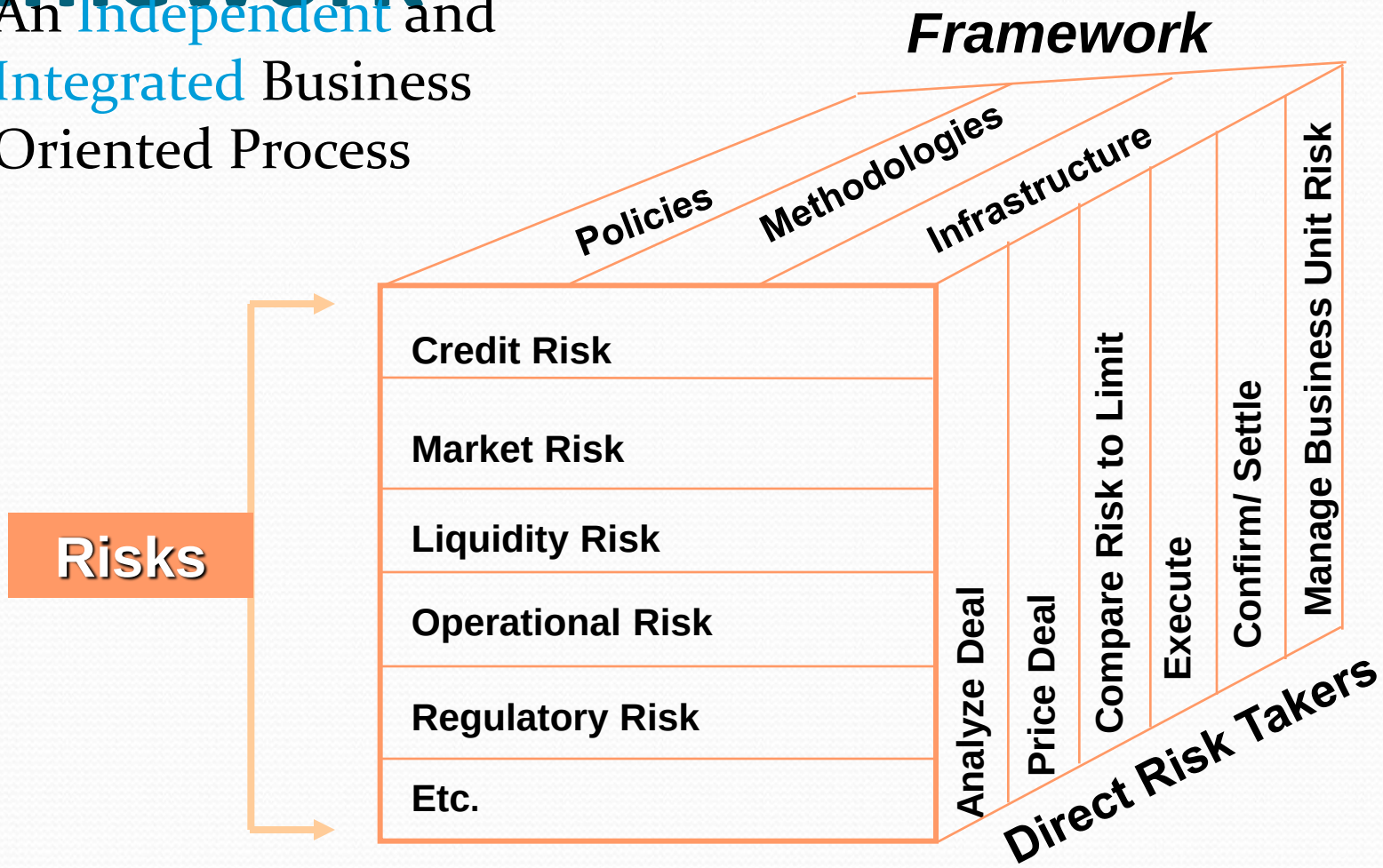


Framework

- An Independent and Integrated Business Oriented Process



Framework

- Active portfolio management is a key component of first class proactive Risk Management

Framework - Policies

Framework - Policies

- These policies explicitly state our risk appetite, expressed in terms of a potential worst case loss.

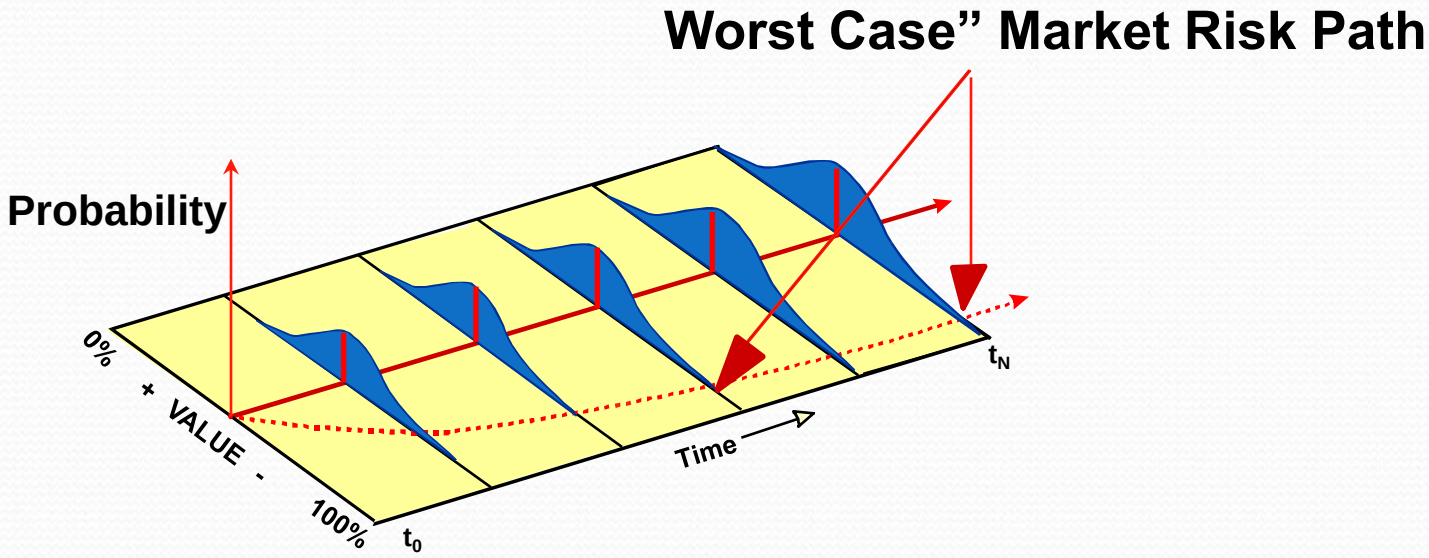
Framework - Policies

EXAMPLES

- Market Risk Policy
  - **Measure market risks in terms of a "worst case" loss**
- Credit Risk Policy
  - **Measure credit exposure in terms of a daily**
  - **mark-to-market plus "worst case" future exposure**
- Operational Risk Policy
  - **Vet all models to be used to revalue positions**

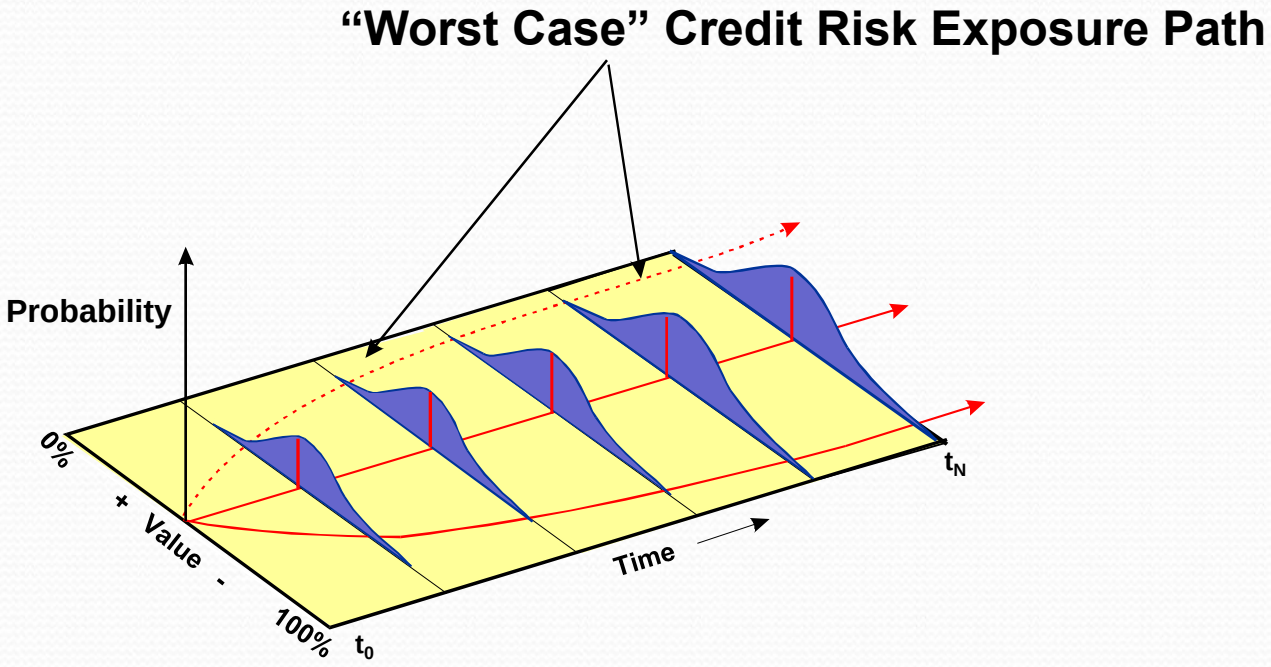
Framework - Policies

- Worst Case Market Risk

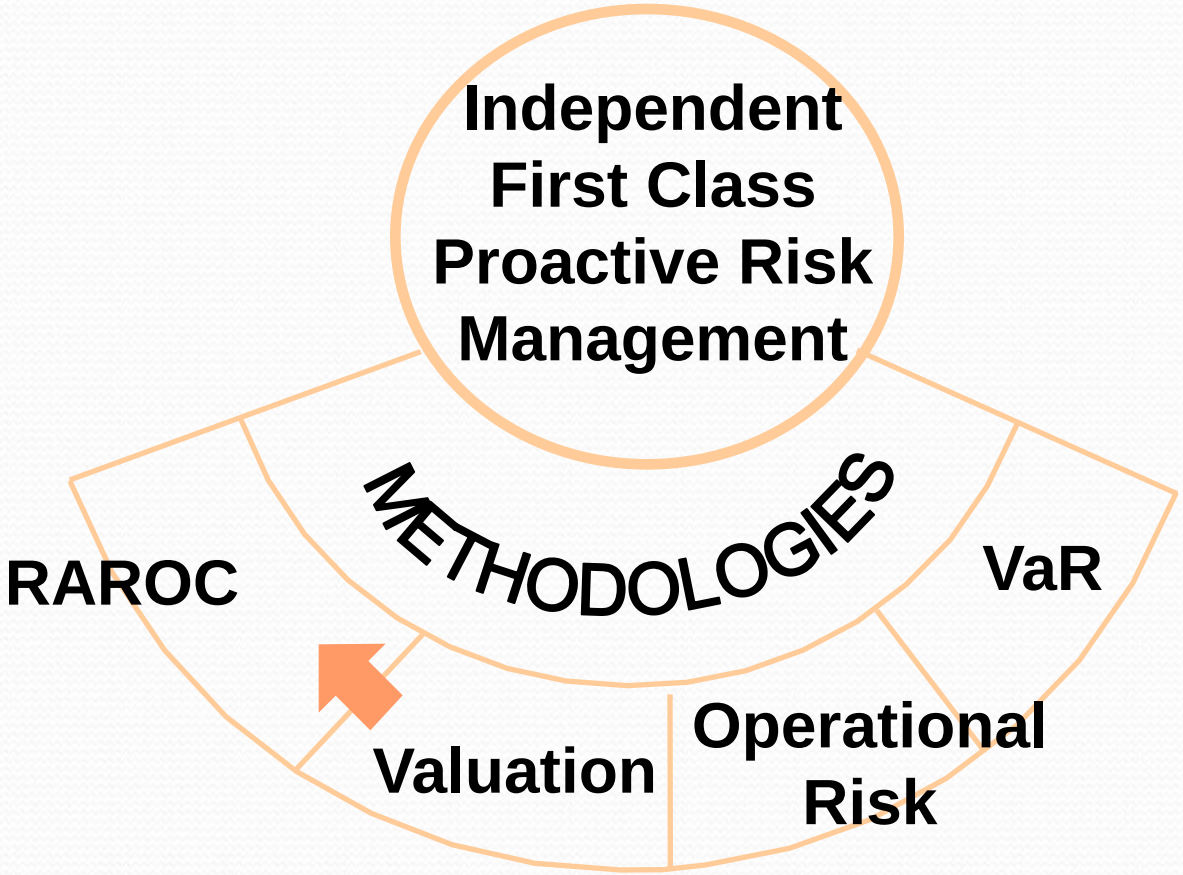


Framework - Policies

- Worst Case Credit Risk Exposure



Framework - Methodologies



Framework - Methodologies

Market and Credit Risk Quantification of Risk

- Value at Risk (at N standard deviations)
  - **Transaction risk**
  - **Portfolio risk (capture correlation effect)**
- Event Risk
  - **Reasonable Paranoia**
  - **Scenario Testing**
    (e.g. volatility and correlation slippage)

Framework - Methodologies

- Value-At-Risk Framework

  Construct families of functions f such that:

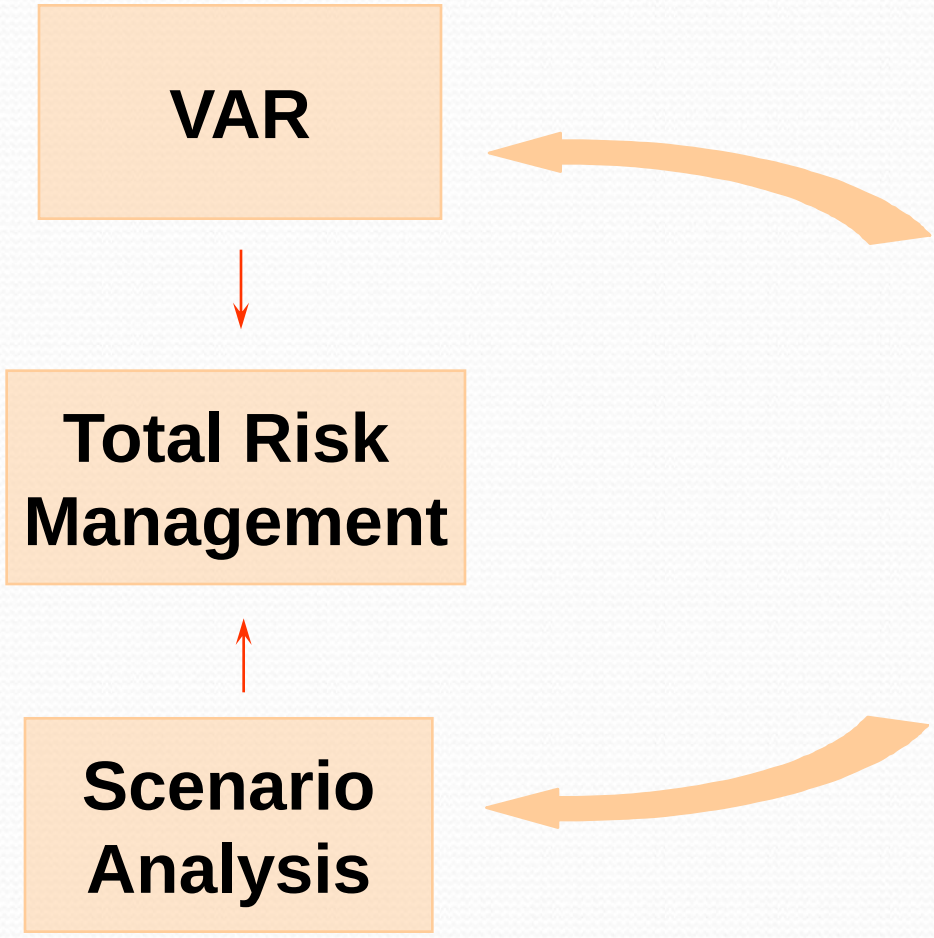
Market Risk $=$ f (
- **Volatilities**
- **Correlations**
- **Liquidity Period**
- **Market Value**
- **Etc.**
)

Framework - Methodologies

- Credit losses are estimated through analyses of the future distributions of risk factors

Credit Losses = f (
- **Future Market Value Exposure Distributions**
- **Default Rate Distributions**
- **Recovery Rate Distributions**
)

Framework - Methodologies



Scenario Analysis

Works well for normal markets

Accounts for unusual markets
(The past cannot always predict the future)

Framework - Methodologies

Stress Testing Scenario - Example 1:

- Equity markets fall around the globe (US 10 %, Canada 7%, Hong Kong 15 %, Europe 10 % on average)
- An upward shift in implied volatilities of from 15% to 50 %
- Dollar rallies against other currencies : Asian Currencies lose 6 - 8 %
- Rates fall in Western markets - HKD rates rise by 40 bps

Framework - Methodologies

Stress Testing Scenario - Example 2:

- 10 % drop in TSE
- 30 % upward shift in implied volatility
- 6 % depreciation of CAD against USD
- FX volatility rise by 40 % in all currency pairs that include CAD
- CAD interest rates rise 150 bp at short end and 50 bp at the long end; 20 % upward shift in implied volatility

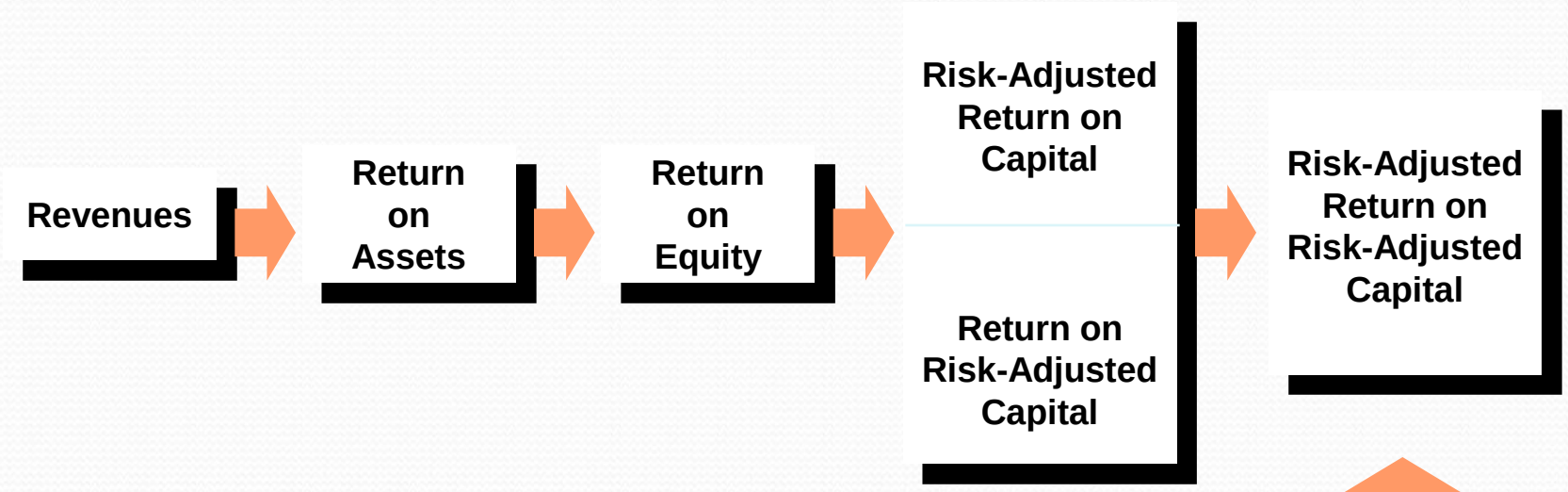
Framework - Methodologies

Stress Testing Scenario - Example 3:

- Credit Spreads move upward by 10 bp (AAA) to 100 bp (B)
- Swap spreads increase 7 bp in major currencies
- European currencies strengthen by 2 %

Framework - Methodologies

- Risk Adjusted Return on Risk Adjusted Capital



Evolution of Performance Measures

Framework - Methodologies

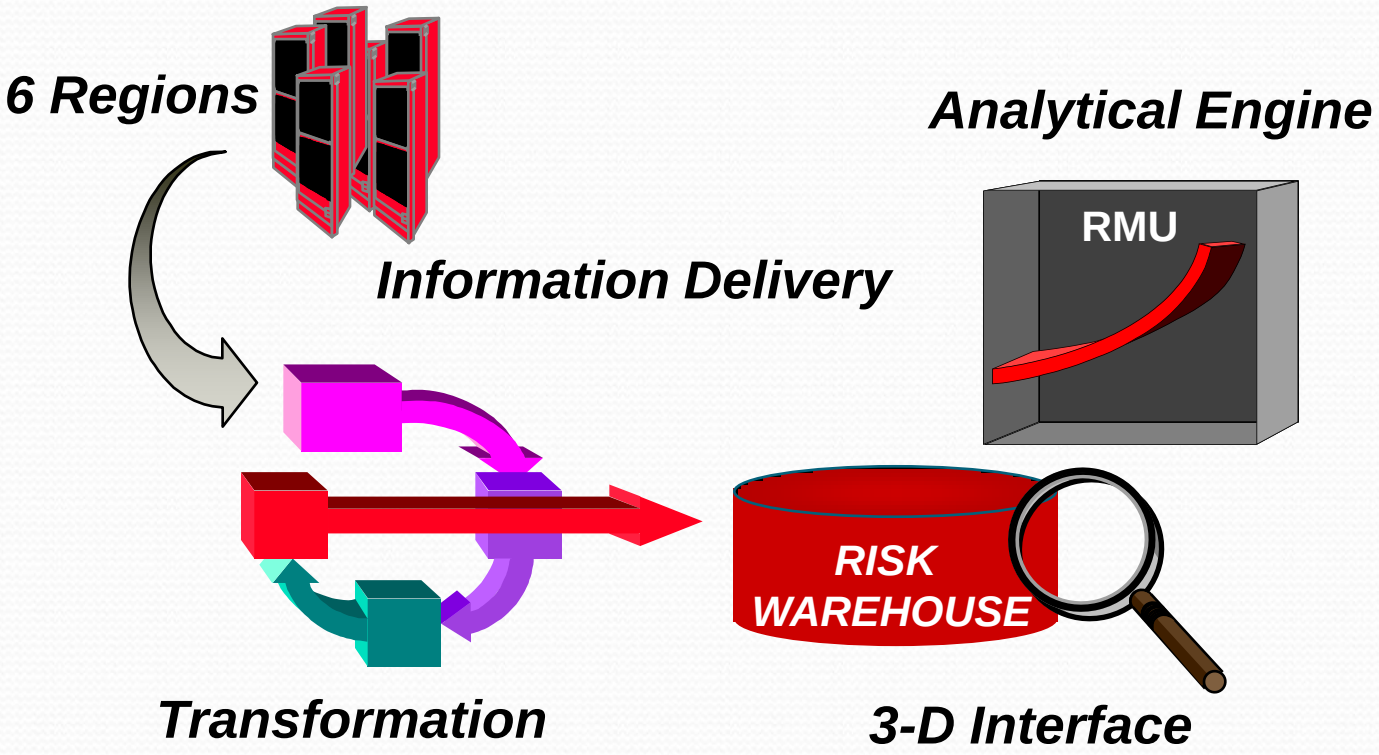
- Calculating Risk Adjusted Return on Risk Adjusted Capital (RARORAC)

$$\text{RARORAC} = f\left(\begin{array}{l}\text{Direct \& Indirect Revenues}\\ \text{Direct \& Indirect Expenses}\\ \text{Credit Risk Factors}\\ \text{Market Risk Factors}\\ \text{Correlation Effect}\\ \text{Balance Sheet Constraints}\end{array}\right)$$

Framework - Infrastructure

Framework - Infrastructure

- Frontier - Risk MIS



III.

Transforming Risk into Value

We are on the verge of a transformational shift

Advances in Risk Management are being borrowed from the trading world in order to transform the approach to capital and balance sheet management

Today

The regulatory community is:

- Finding it increasingly difficult to keep pace
- Beginning to acknowledge that standardized regulatory measures fail to provide sufficient transparency

Why is this so?

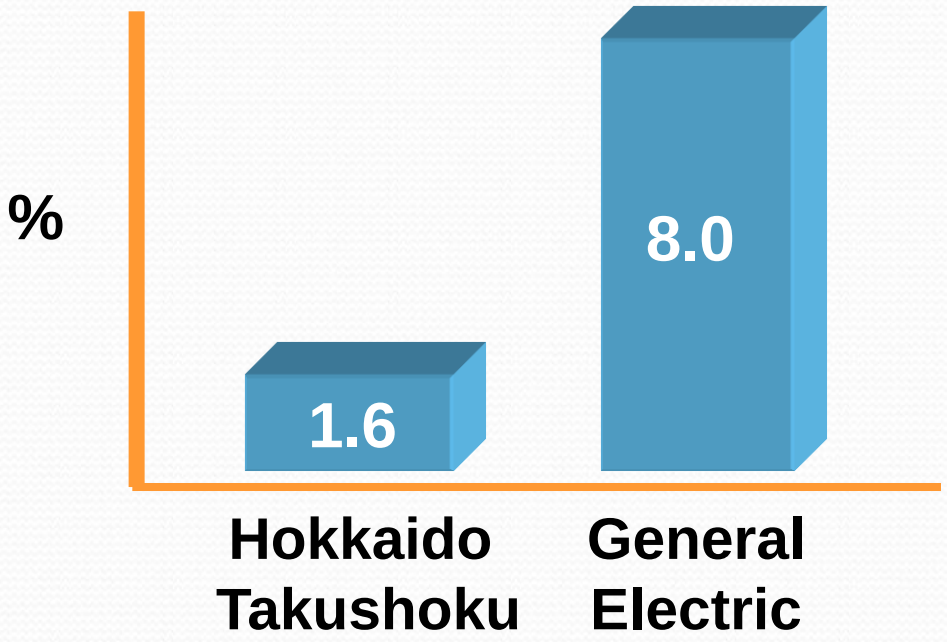
Let's take a look at a few examples

Example #1: Short Term Revolvers

- An unfunded revolver with a term of less than one year does not require any regulatory capital

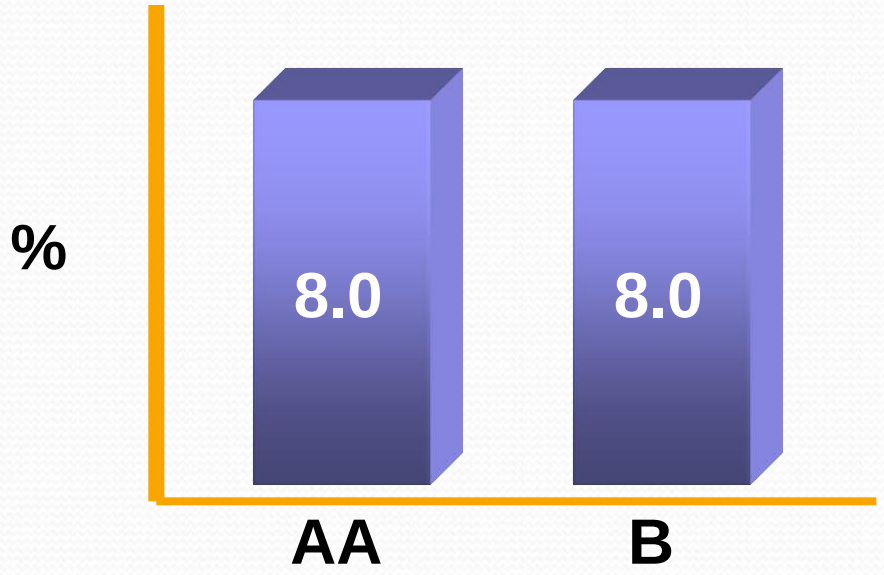
Example #2: Corporations vs. OECD Banks

- A loan to GE requires 5 times as much regulatory capital as a loan to Hokkaido Takushoku



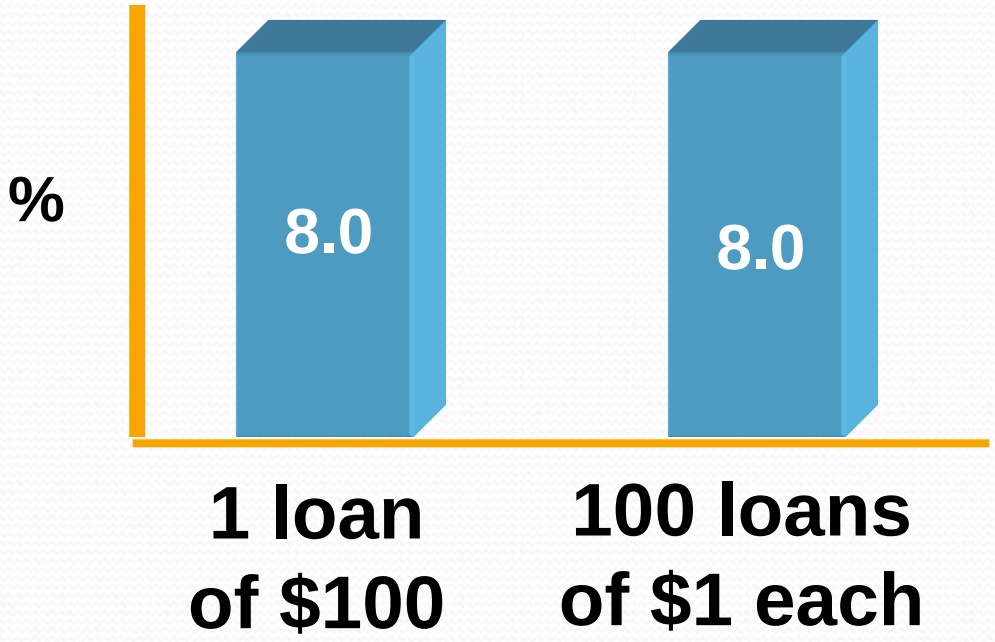
Example #3: Investment Grade vs. Non-investment Grade Lending

- A loan to a AA-rated corporate requires the same amount of capital as a loan to a B-rated corporate



Example #4: Level of Diversification

- A single loan requires the same amount of regulatory capital as a diversified portfolio

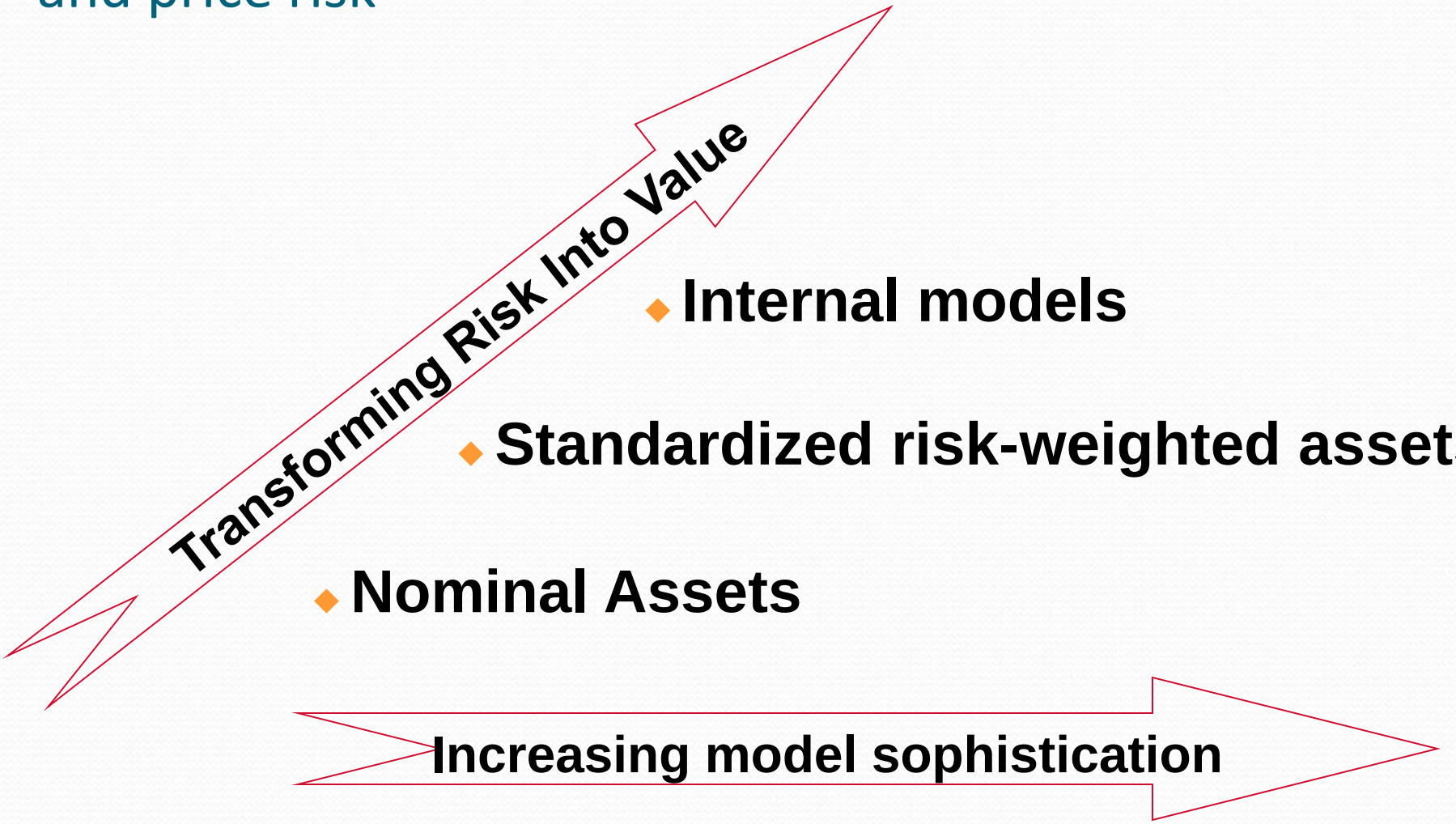


Recent Events and Emerging Trends

Trend #1: Regulatory approval of internal models for trading book

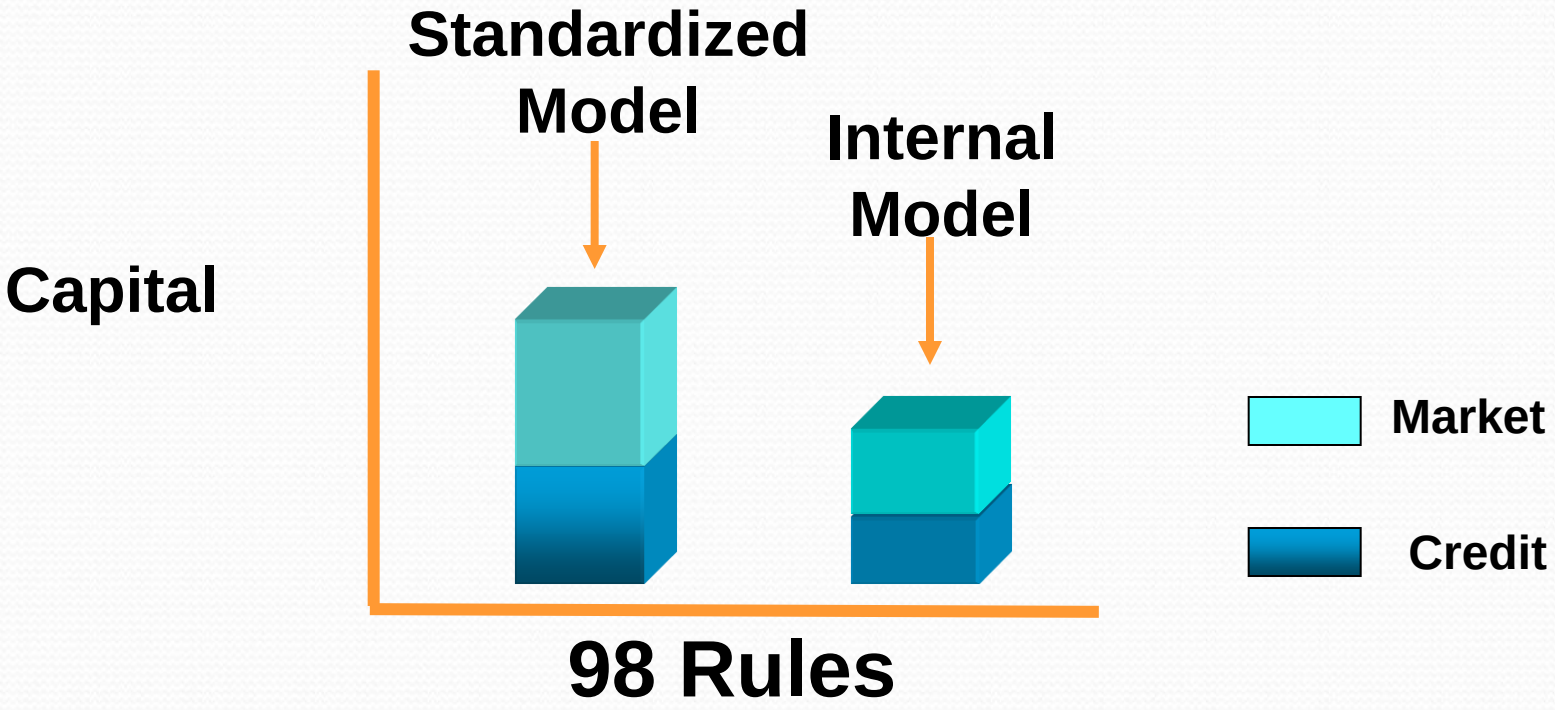
- Banks have a choice of using either a standardized or an internal model to calculate regulatory capital for the trading book (1998 Rules)

Greater transparency and improved ability to manage and price risk

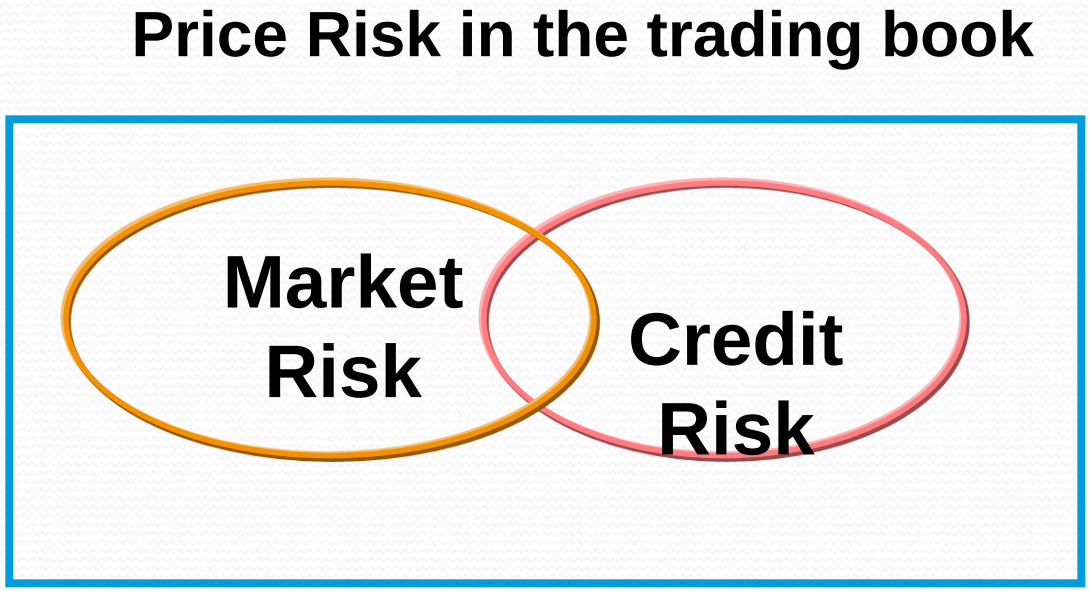


Opportunities for a Regulatory Capital Advantage

- Example: 30 year Corporate Bond



Trend #2: Internal Models which measure Intersection of Market Risk and Credit Risk in the Trading Book



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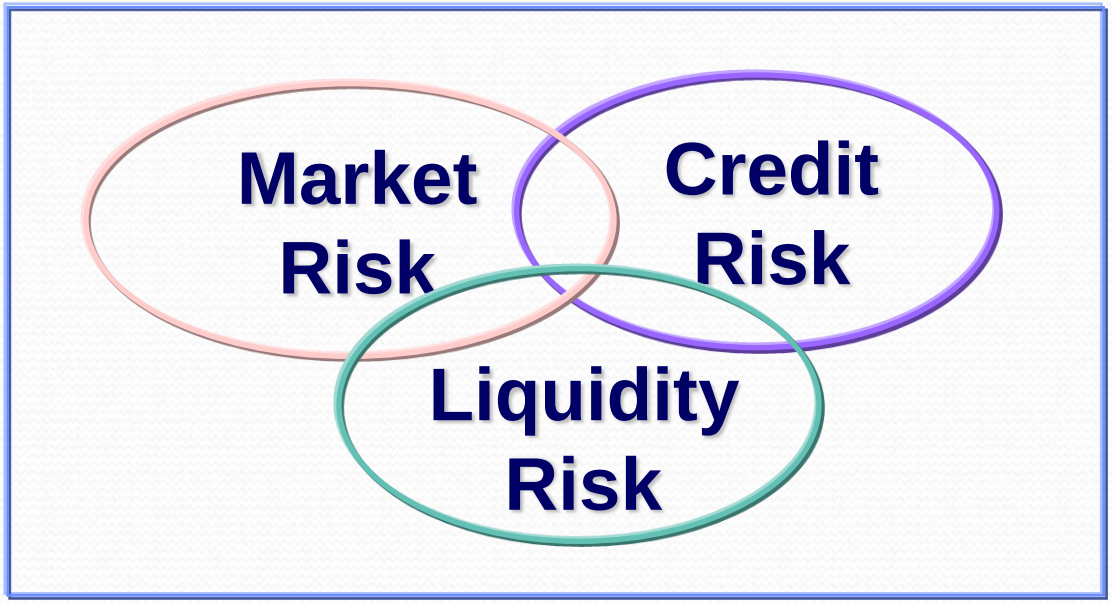


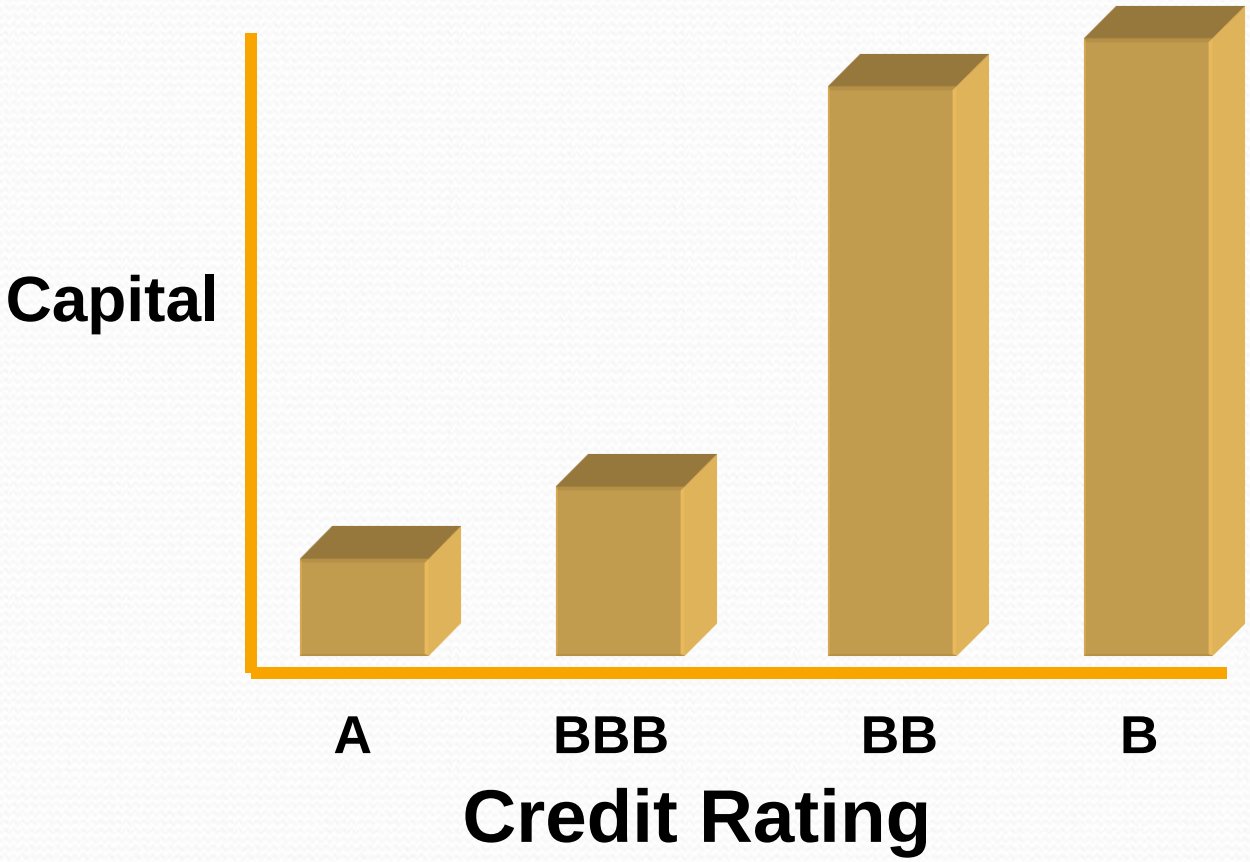
The Asian Contagion

Trading Market Risk	Liquidity Risk	Trading Credit Risk
Asian Currencies Declined	Market Liquidity Dried Up	Credit Spreads Widened
Equities Fell	Enterprise Liquidity Dried Up	Declining Credit Quality
Interest Rates Unstable	Financial System Under Stress	Defaults Increased

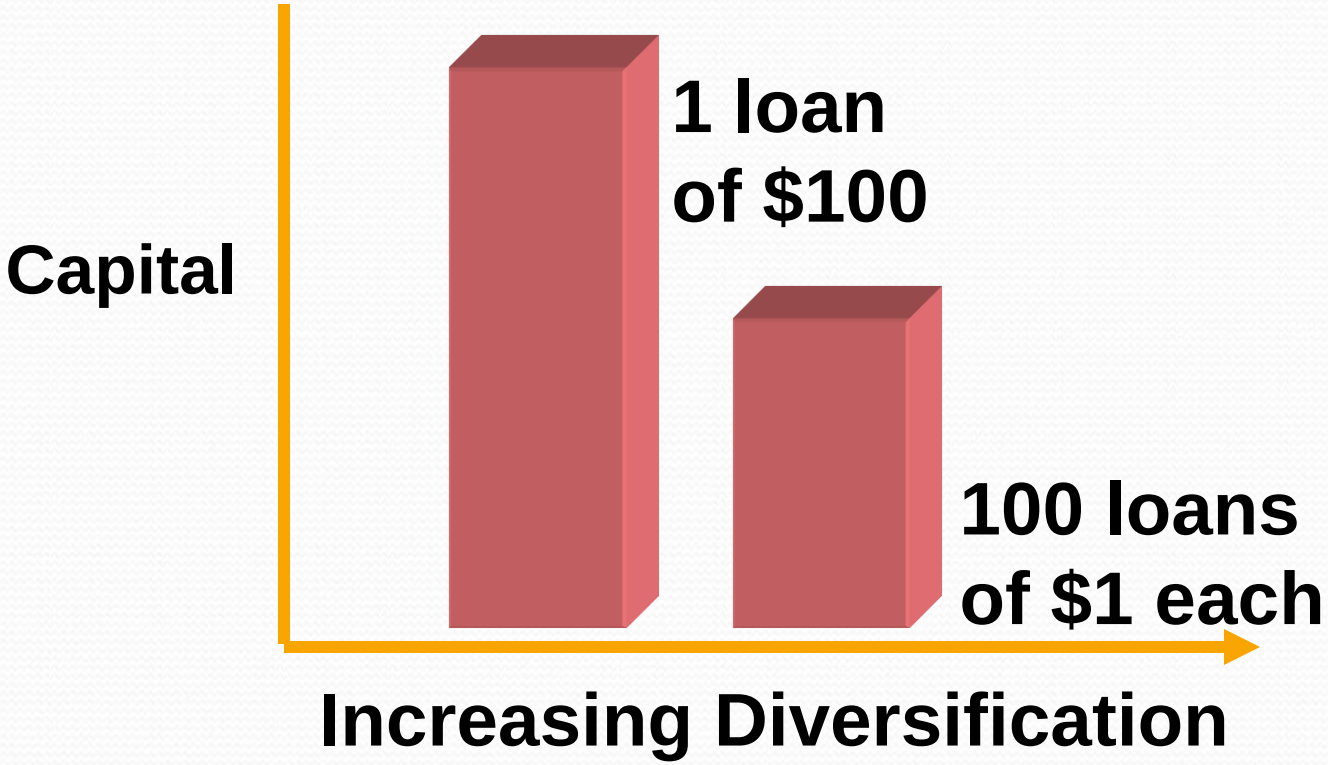
Trend #3: Development of Internal Models for the Banking Book

- Sophisticated banks are working hard to develop internal models
  - JP Morgan
- So are leading model vendors
  - KMV

Our internal analytic risk models are being used to assign capital based on risk for the banking book



Our internal analytic risk models reflect the level of concentration risk

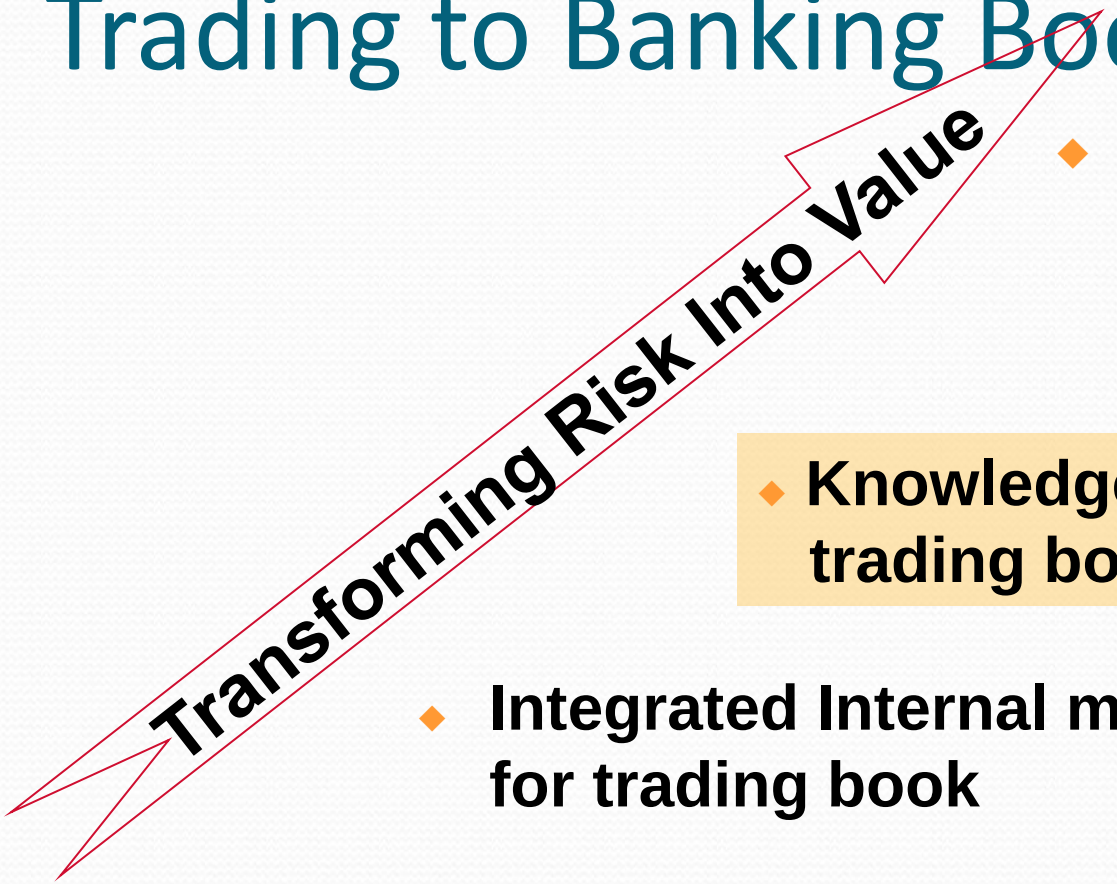


Trend #4: Regulatory Approval for the Banking Book

Today	***Future***
Internal models for the TRADING book	**Internal models for the BANKING book**

Transforming Risk into Value

Knowledge Transfer from Trading to Banking Book



- **Integrated Internal models for banking book**
- **Knowledge transfer from trading book to banking book**
- **Integrated Internal models for trading book**

Increasing Model Sophistication

Trend #5: Regulators will encourage the use of internal models

- Regulators concerned about significant reduction in regulatory capital brought about by
  - **allowing banks to use their internal models**
  - **regulatory arbitrage**

Future: Regulatory Response

- Implications:

  If regulators scale up regulatory capital,
  then sophisticated banks that have internal models
  will continue to have a relative capital advantage

IV.

New Capital Adequacy Framework*

* For more details, see Chapter-2, “Risk Management” by Crouhy, Galai and Mark

Menu of Approaches

- *For Measuring Market Risk* - *BIS 98*
  - **Standardized Approach**
  - **Internal VaR Models**
- *For Measuring Credit Risk* - *BIS 2000+*
  - **Standardized Approach**
  - **Foundation Internal Ratings-based Approach**
  - **Advanced Internal Ratings-based Approach**
- *For Measuring Operational Risk* - *BIS 2000+*
  - **Basic Indicator Approach**
  - **Standardized Business Line Approach**
  - **Internal Measurement Approach**

V.

BIS 98*

* For more details, see Chapters 2 and 4, “Risk Management” by Crouhy, Galai and Mark

The New 1998 BIS and CAD II Accord

Applies to the *trading book* and encompasses:

- General market risk
  - **Change in market value resulting from broad market movements**
- Specific risk (idiosyncratic or credit risk)
  - **Adverse price movements due to idiosyncratic factors related to individual issuers**

BIS 98

- Regulatory capital required for market risk associated with the trading book:
  - **General market risk**

    {3 * sqr(10) * market-risk VaR}* (trigger/8)

  - **Specific risk** (equities and corporate bonds)

    {4 * sqr(10) * specific-risk VaR}*(trigger/8)

BIS 98

- Multipliers (3 for general market risk and 4 for specific risk) reward the quality of the models
- The "trigger" relates to the control process (8 to 25)
- Total Capital
  - **1998 BIS Accord**

    +
  - **Modified 1988 BIS Accord**

BIS 98

- Internal models vs Standardized approach

  - **capture portfolio effects**
  - **allow to incorporate credit risk mitigation techniques and hedging strategies**
  - **provide opportunity for capital reduction through a better risk assessment**

BIS 98

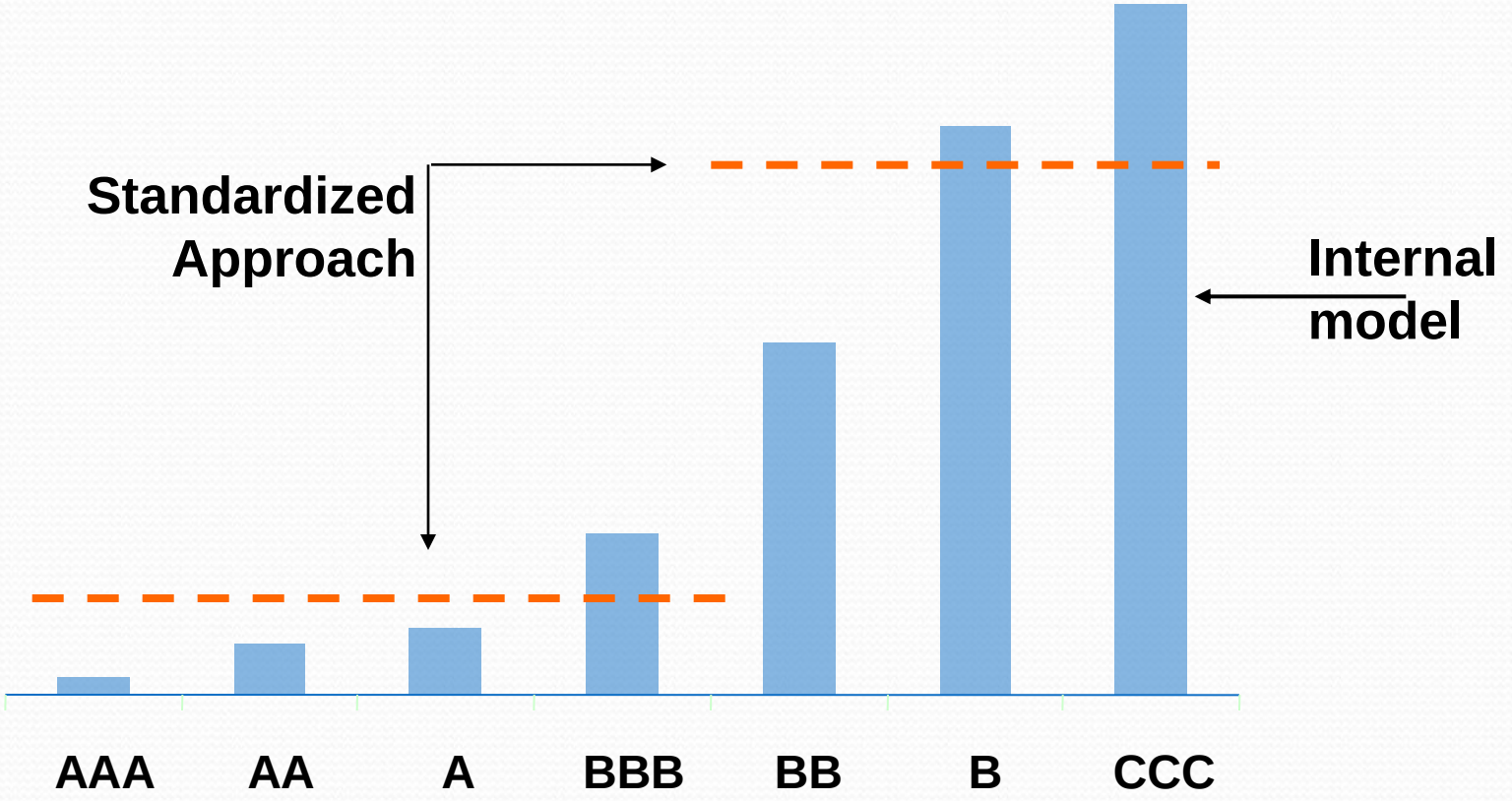
- …but also for a more accurate allocation of capital

Example: Portfolio of 100 $1 bonds diversified across industries

Capital charge for specific risk (%)

	Internal model	Standardized approach
AAA	0.26	1.6
AA	0.77	1.6
A	1.00	1.6
BBB	2.40	1.6
BB	5.24	8
B	8.45	8
CCC	10.26	8

BIS 98



VI.

The New Basel Capital Accord*

(BIS 2000+)

* For more details, see Chapter-2, “Risk Management” by Crouhy, Galai and Mark

BIS2000+

- In 1999 several consultative papers have been issued
  - **Credit Risk Modeling (April)**
  - **A new Capital Adequacy Framework (June)**
  - **Credit Risk Disclosure**
  - **Principles for the management of credit risk**
  - **Settlement risk in foreign exchange**
- January 16, 2001
  - **New Basel Accord**

    (BIS is seeking comments by the end of May 2001, with expectation that the final version will be published by the end of 2001, and come into effect in 2004)

Some existing shortfalls

- Credit Risk
  - **Undifferentiated by risk**
  - **No benefit for diversification**
  - **Tenor and structural arbitrage**
- Interest rate risk in banking book
  - **No (explicit) capital**
- Operational risk
  - **No (explicit) capital**

The New Basel Capital Accord

Minimum Capital Requirement

Supervisory Review Process

Market Discipline Requirements

Scope of Application

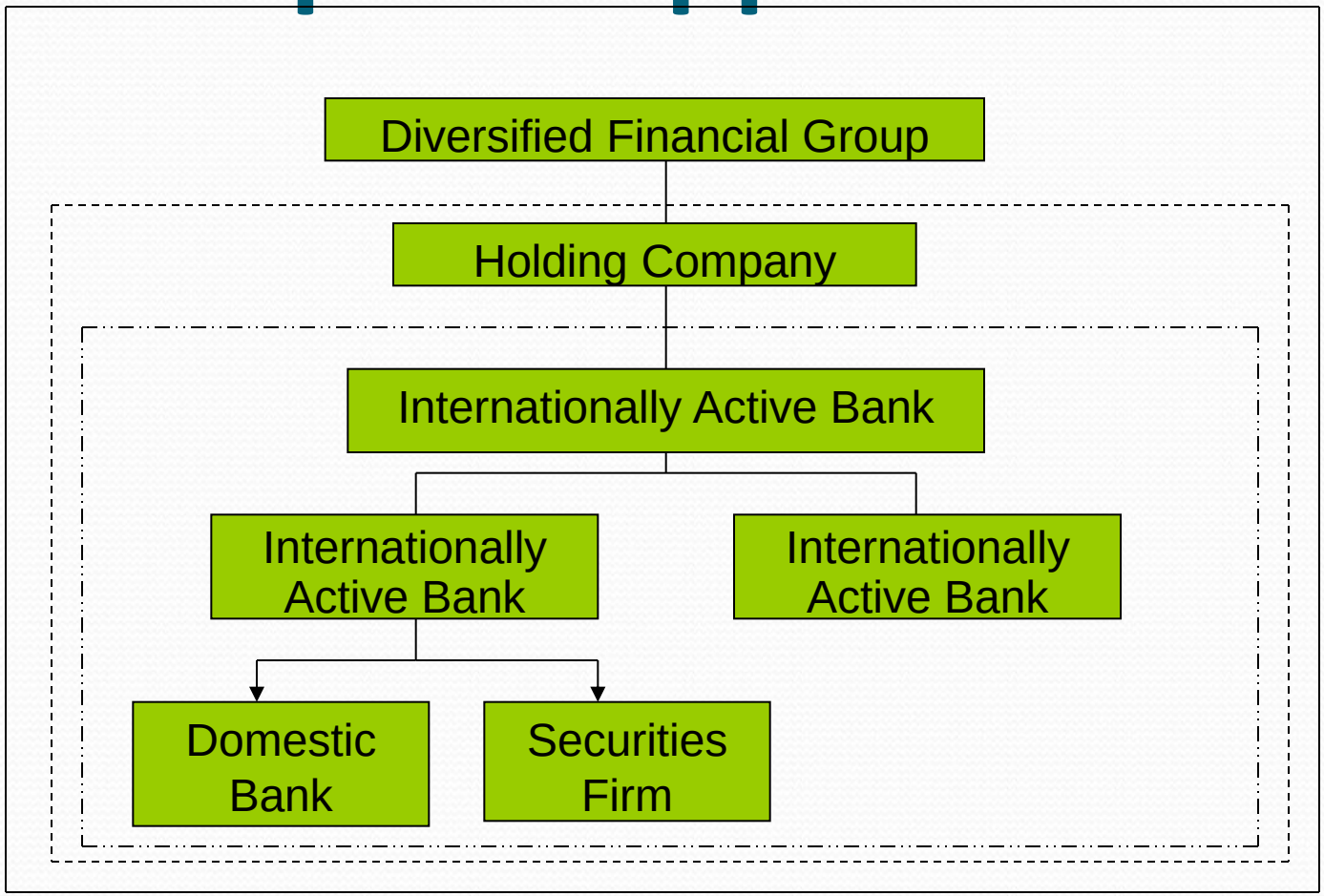
- Current Accord

Applicable to banks on a consolidated basis

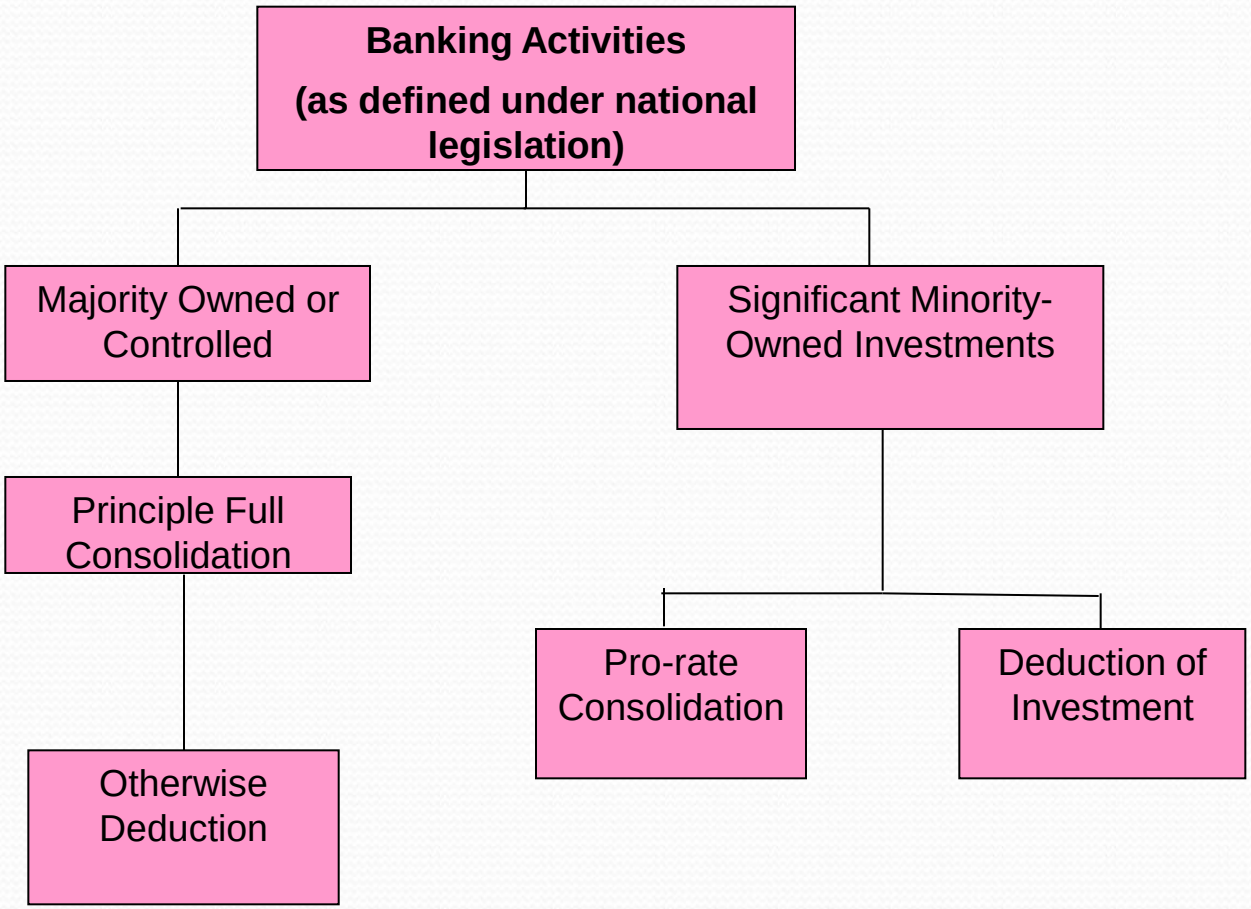
- **including subsidiaries undertaking banking and financial business**

- **but without further specification**

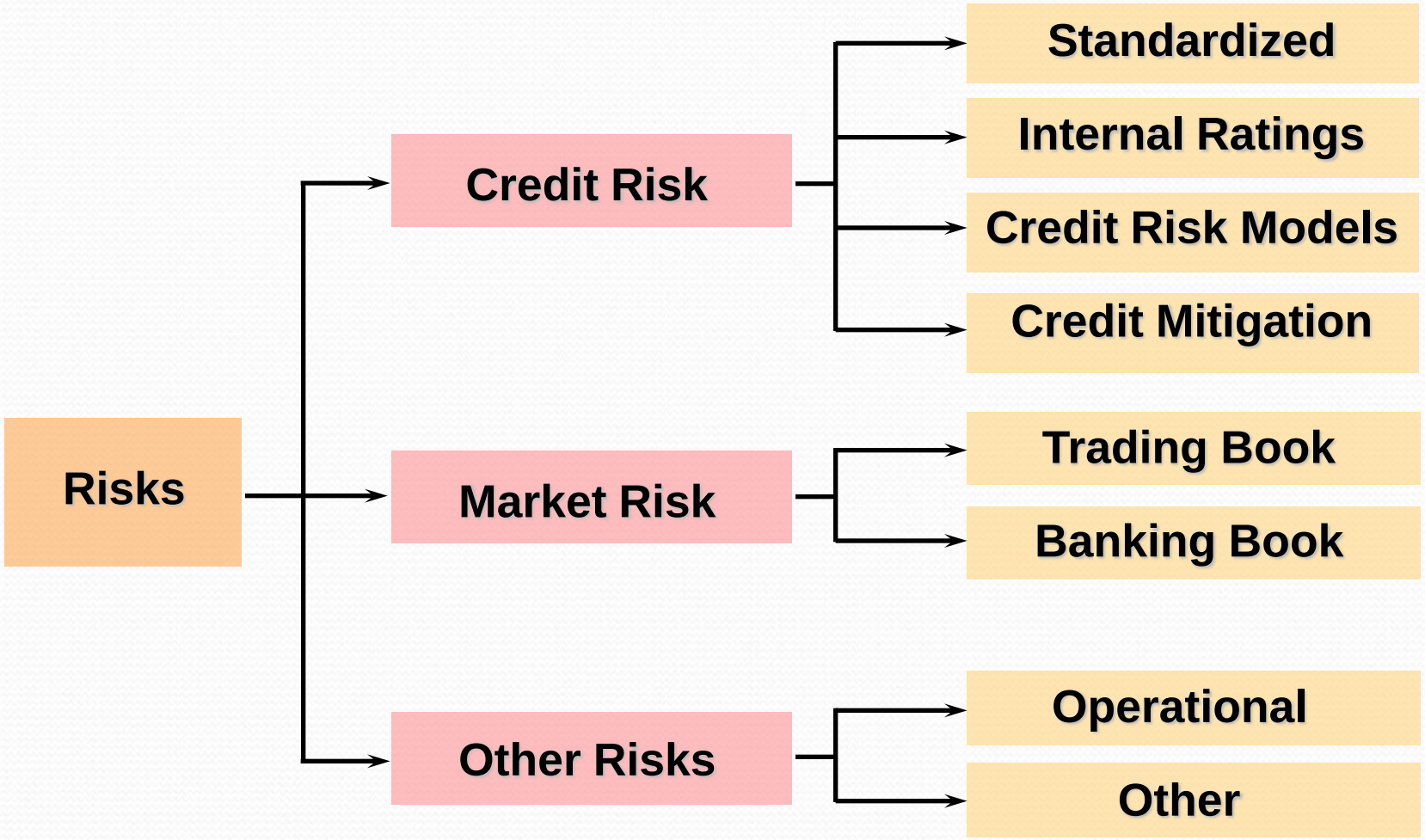
New Scope of Application



Subsidiaries and Other Financial Activities



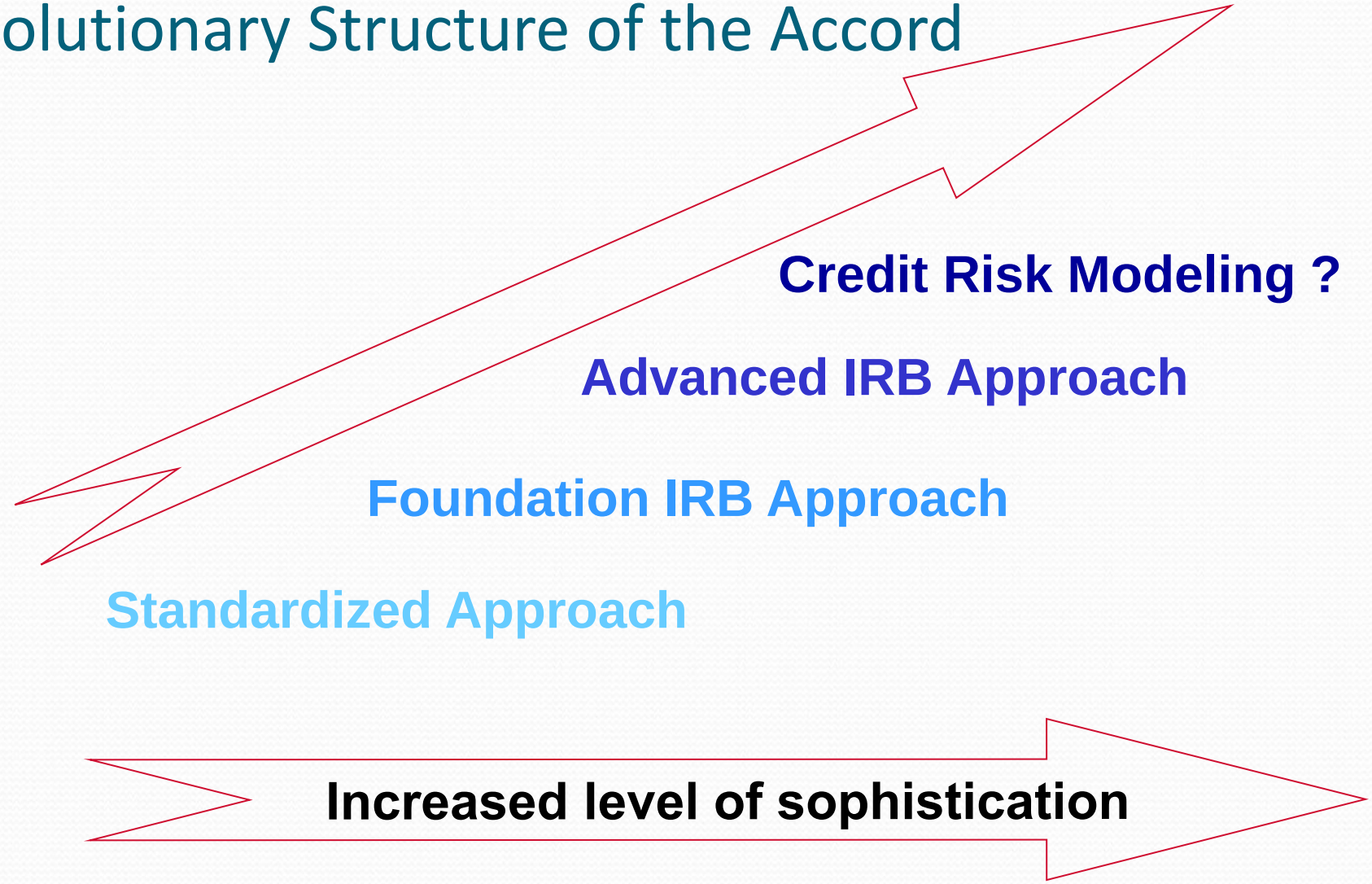
Minimum Capital Requirement
Pillar One



1. Minimum Capital Requirements (Pillar One)

- Standardized approach
  (External Ratings)
- Internal ratings-based approach
  - **Foundation approach**
  - **Advanced approach**
- Credit risk modeling
  (Sophisticated banks in the future)

Evolutionary Structure of the Accord



The New Basel Capital Accord

- Securitization [Additional work required]
- Project Finance [Additional Work Required]
- Equity [Additional Work Required]
  - Merchant Banking Book

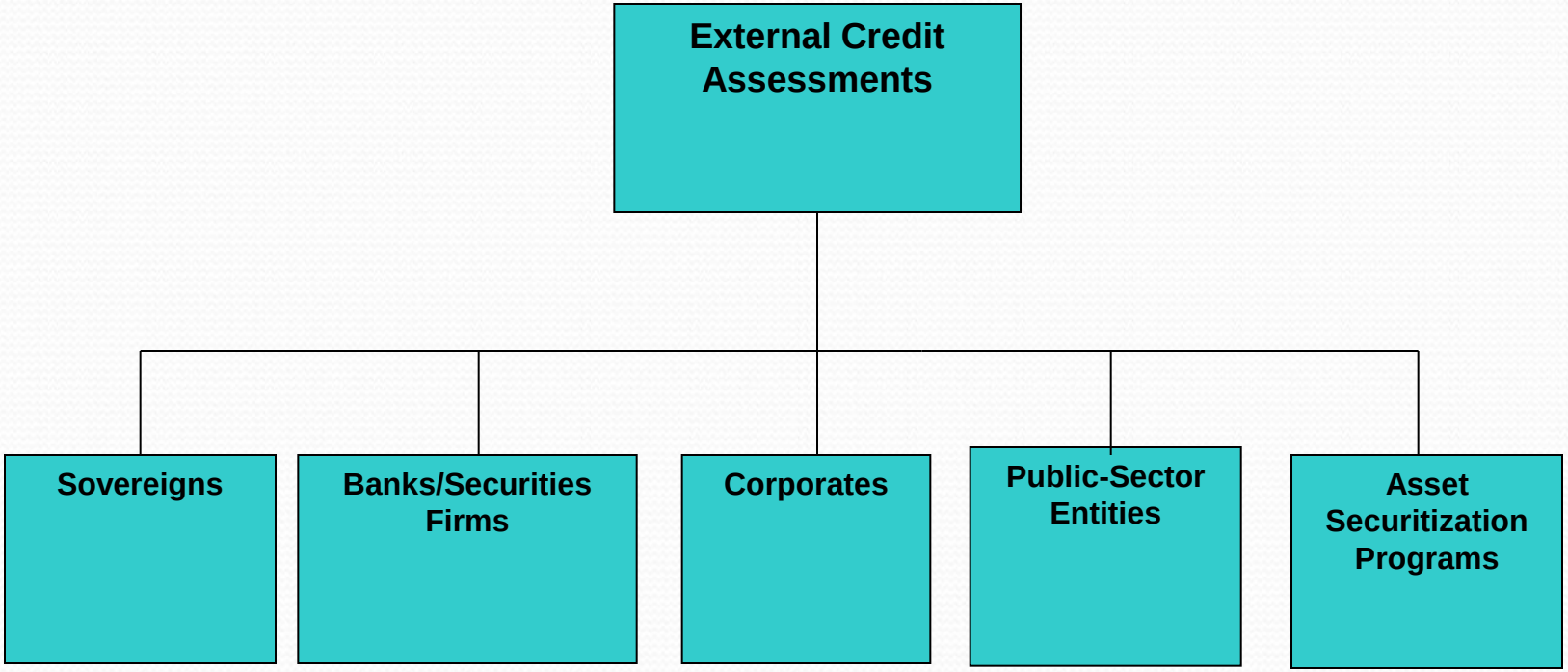
The New Basel Capital Accord

Standardized Approach

- **Provides Greater Risk Differentiation than 1988**
- **Risk Weights based on external ratings**
- **Five categories** [0%, 20%, 50%, 100%, 150%]
- **Certain Reductions**
  - **e.g. short term bank obligations**
- **Certain Increases**
  - **e.g.150% category for lowest rated obligors**

Standardized Approach

Based on assessment of external credit assessment institutions



Standardized Approach: New Risk Weights (June 1999)

Claim		Assessment					
		AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
Sovereigns		0%	20%	50%	100%	150%	100%
Banks	Option 1[1]	20%	50%	100%	100%	150%	100%
	Option 2[2]	20%	50%[3]	50%[3]	100%[3]	150%	50%[3]
Corporates		20%	100%	100%	100%	150%	100%

[1] Risk weighting based on risk weighting of sovereign in which the bank is incorporated.

[2] Risk weighting based on the assessment of the individual bank.

[3] Claims on banks of a short original maturity, for example less than six months, would receive a weighting that is one category more favourable than the usual risk weight on the bank's claims

Standardized Approach: New Risk Weights (January 2001)

Claim		Assessment					
		AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB- (B-)	Below BB- (B-)	Unrated
Sovereigns		0%	20%	50%	100%	150%	100%
Banks	Option 1[1]	20%	50%	100%	100%	150%	100%
	Option 2[2]	20%	50%[3]	50%[3]	100%[3]	150%	50%[3]
Corporates		20%	50%(100%)	100%	100%	150%	100%

[1] Risk weighting based on risk weighting of sovereign in which the bank is incorporated.

[2] Risk weighting based on the assessment of the individual bank.

[3] Claims on banks of a short original maturity, for example less than six months, would receive a weighting that is one category more favourable than the usual risk weight on the bank's claims

Internal Ratings-Based Approach

- Two-tier ratings system:
  - **Obligor rating**
    - **represents probability of default by a borrower**
  - **Facility rating**
    - **represents expected loss of principal and/or interest**

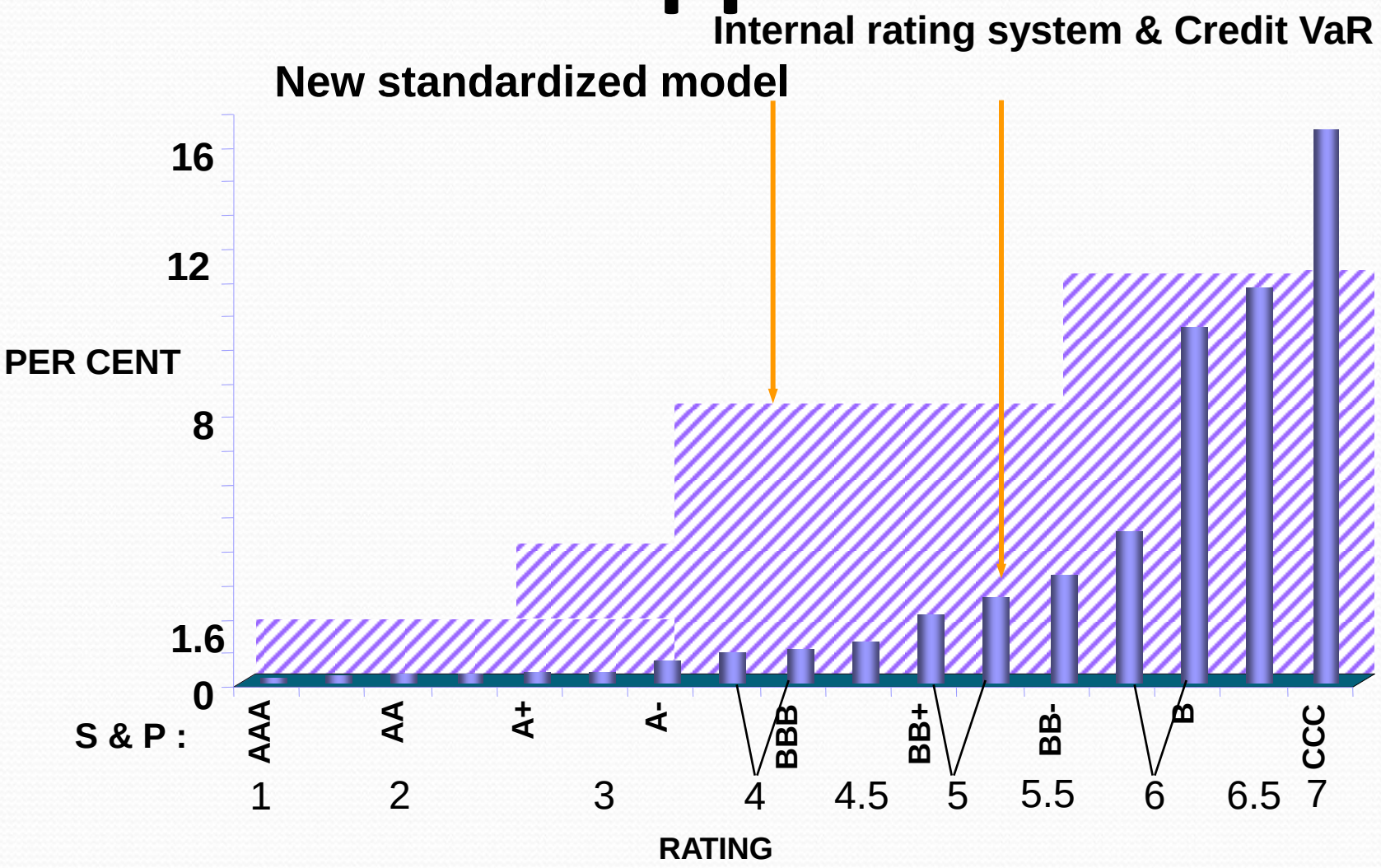
ISDA proposed "standard approach"

Example: Relative Capital Weights: 99.5% confidence level; LGD = 100%

Prob. Def. %	≤ 0.5 Yr	0.5-1 Yr	1-2 Yr	2-3 Yr	3-4 Yr	4-5 Yr	5-6 Yr	6-7 Yr	7-8 Yr	8-9 Yr	> 9 Yr
0.00 – 0.025	6	8	12	17	21	25	28	32	36	40	43
0.025 – 0.035	9	12	17	23	29	35	40	46	51	56	60
0.03 5 – 0.045	13	17	24	31	38	46	52	58	66	73	80
0.04 5 – 0.055	16	20	28	36	44	52	59	65	74	81	89
0.055 – 0.065	18	24	32	41	49	58	65	73	81	89	98
0.065 – 0.085	22	29	38	47	56	65	73	81	91	100	109
0.085 – 0.115	27	34	45	56	66	76	85	94	104	114	123
0.115 – 0.165	36	46	59	72	86	97	108	119	130	140	151
0.165 – 0.255	48	60	80	100	118	134	149	164	178	191	203
0.255 – 0.405	72	86	108	130	150	168	186	202	216	230	241
0.405 – 0.635	100	119	145	172	195	216	236	254	269	283	294
0.635 – 0.915	140	163	190	215	238	257	275	292	305	317	327
0.915 – 1.335	181	207	231	253	273	290	307	321	331	342	351
1.335 1.945	240	271	293	312	330	345	359	371	379	388	395
1.945 – 3.875	370	409	420	430	440	450	457	463	466	473	476
3.875 – 7.705	662	716	719	721	724	726	727	727	727	727	727
7.705 – 14.995	1083	1163	1164	1166	1166	1168	1168	1168	1168	1168	1168
14.995 – 20.000	1619	1718	1718	1718	1718	1718	1718	1718	1718	1718	1718

Weights are average values derived by 6 international banks and sponsored by ISDA (**BBB 3yr = 3.45%**)

Standardized Approach



Internal Ratings-Based Approach

- **Three elements:**
  - **Risk Components [PD, LGD, EAD]**
  - **Risk Weight conversion function**
  - **Minimum requirements for the management of policy and processes**
  - **Emphasis on full compliance**

Definitions;

PD = Probability of default [“conservative view of long run average (pooled) for borrowers assigned to a RR grade.”]

LGD = Loss given default

EAD = Exposure at default

Note: BIS is Proposing 75% for unused commitments

EL = Expected Loss

Internal Ratings-Based Approach

Risk Components

- **Foundation Approach**
  - PD set by Bank
  - LGD, EAD set by Regulator
    50% LGD for Senior Unsecured
    Will be reduced by collateral (Financial or Physical)

- **Advanced Approach**
  - PD, LGD, EAD all set by Bank
  - Between 2004 and 2006: floor for advanced approach @ 90% of foundation approach

Notes

- Consideration is being given to incorporate maturity explicitly into the "Advanced"approach
- Granularity adjustment will be made. [not correlation, not models]
- Will not recognize industry, geography.
- Based on distribution of exposures by RR.
- Adjustment will increase or reduce capital based on comparison to a reference portfolio [different for foundation vs. advanced.]

Exposure at Default

- On-balance-sheet items: nominal outstanding amount.
- Off-balance-sheet positions
  - **Foundation approach**
    - **Same credit conversion factors as in 1988 Accord.**
    - **Exception: commitments >75% for undrawn amount**
  - **Advanced Approach**
    - **Banks can use their own internal estimates**

Credit conversion factors for non-derivative off-balance sheet exposures

Conversion factor (%)	Off- balance sheet exposure factor
100	Direct credit substitutes, bankers' acceptances, standby letters of credit, sale and repurchase agreements, forward purchase of assets.
50	Transaction-related contingencies such as performance bonds, revolving underwriting facilities (RUFs) and note issuance facilities (NIFs).
20	Short-term self-liquidating trade related contingencies such as letters of credit.
0	Commitments with an original maturity of one year or less.

Approach Variations

		Internal Rating		
	Standard Approach	**Foundation Approach**	**Advanced Approach**	**Credit Risk Models**
Risk Weights	5	More	More	More
PD	Accord	Bank	Bank	Bank
LGD	Accord	Accord	Bank	Bank
EAD	Accord	Accord	Bank	Bank
Correlations	No	No	No	Yes

Risk Weight for Corporate exposures:

$$RW_C = (LGD/50) * BRW_C(PD) * [1 + b(PD) * (M - 3)]$$

or $(12.5 * LGD)$ whichever is smaller.

$BRW_C(PD) =$ **Corporate benchmark risk weight**:

$$976.5 * N(1.118 * G(PD) + 1.288) * (1 + .0470 * (1 - PD) / PD^{0.44})^{10}$$

PD = probability of default

M = maturity

$$b(PD) = \frac{0.235 * (1 - PD)}{PD^{0.44} + .0470 * (1 - PD)}$$ [1]

N(x) = cumulative normal distribution

G(z) = inverse cumulative normal distribution

[1] PD is expressed as a decimal (e.g., 0.01 for 1 percent)

- N(1.118xG(PD)+1.288) = sum of expected and unexpected losses associated with a hypothetical, infinitely-granular portfolio of one-year loan having an LGD of 100%, using a so-called Merton-style credit risk model in which there is a single systematic risk factor and the values of borrowers' assets are assumed lognormally distributed, a confidence level of 99.5% and an average correlation of 20%
- The term $(1+.0470x(1-PD)/PD^{0.44})$ is an adjustment to reflect that the IRB benchmark risk weights are calibrated to a 3-year average maturity; and the scaling factor 976.5, which is calibrated so that the IRB benchmark risk weight equals 100% for values of PD and LGD equal to 0.7% and 50% respectively.

Maturity Adjustments to The Risk Weights, Derived From MTM-models

	Maturity Adjustments			
PD(%)	**1 Year**	**3 Years**	**5 Years**	**7 Years**
0.03	0.4	1.0	1.6	2.3
0.05	0.4	1.0	1.6	2.1
0.10	0.5	1.0	1.5	2.0
0.20	0.6	1.0	1.4	1.8
0.50	0.7	1.0	1.3	1.6
1.00	0.7	1.0	1.3	1.5
1.40	0.8	1.0	1.2	1.5
3.30	0.8	1.0	1.2	1.3
6.60	0.9	1.0	1.1	1.3
15.0	0.9	1.0	1.1	1.2

IRB - Risk Weight Function

- Risk weighted assets = risk weight x exposure
- Risk weight = f (PD, LGD, EAD, M)
- PD estimation
  - **Underlying historical observation period at least 5 years.**
  - **Transition period 2004-2007 (start 2 years observation period)**
- Rating system in use for at least 3 years
  - **Transition period 2004 - 2007**

Standardized vs. Foundation IRB Approach vs. Internal Model Approach

Foundation IRB attributes more than twice as much capital as Internal Models (ISDA)

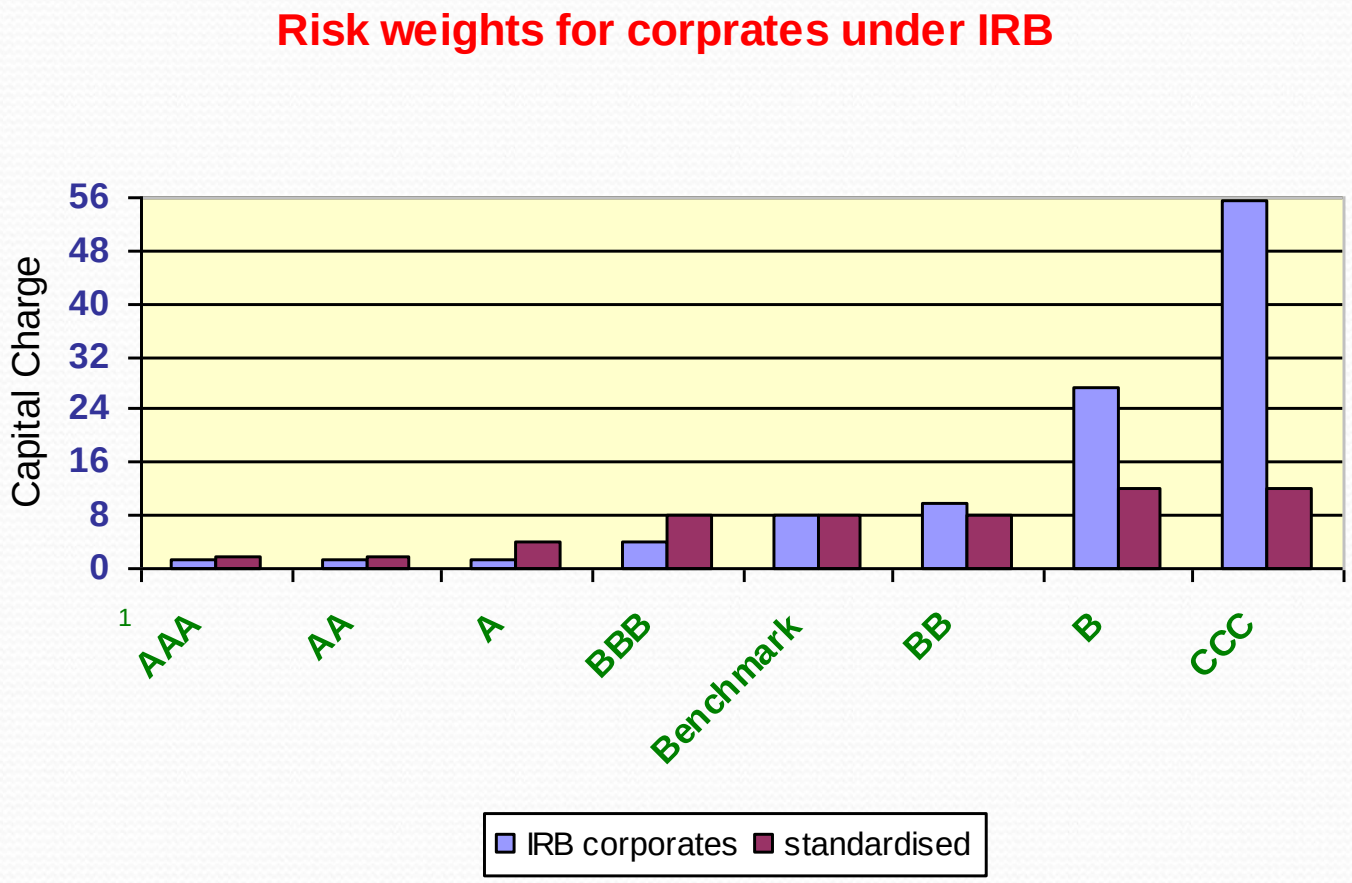
Capital Charges for Standard and Poor's Rating Categories

		Standardized		Foundation		ISDA
S&P Rating	1 Year Historical Default Probability %	Risk Weight %	Capital charge Per $100 of Asset Value	Corporate BRW Risk Weight[1]%	IRB Capital Charge per $100 of Asset Value (LGD = 50%)	Capital Charge (LGD = 50%)
AAA	0.1	20	1.6	14	1.12	.029
AA	0.1	20	1.6	14	1.12	0.29
A	.04	50	4	17	1.34	0.53
BBB	.22	100	8	48	3.83	1.73
Benchmark	.70	100	8	100	8	3.71
BB	.98	100	8	123	9.87	4.36
B	5.30	150	12	342	27.40	12.44
CCC	21.94	150	12	694	55.55	29.64

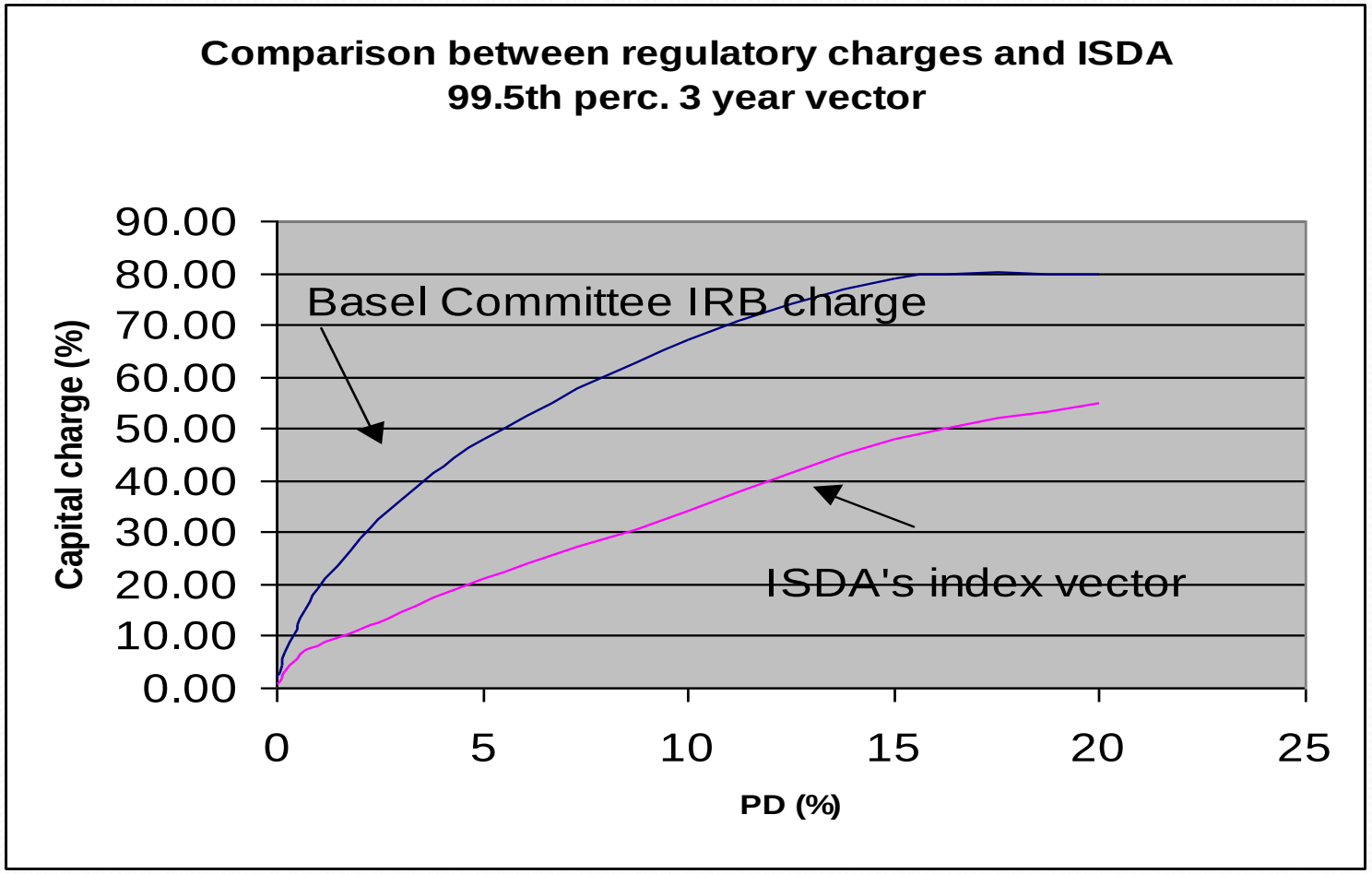
BRW = Benchmark Risk Weight

Note: [1] Formula supplied by BIS.

Risk Weights
Standardized vs. Foundation IRB Approach



Note: [1] Benchmark set at 0.7% PD, 50% LGD, M=3 years



Note: Assumption LGD=100%

Encouragement of models

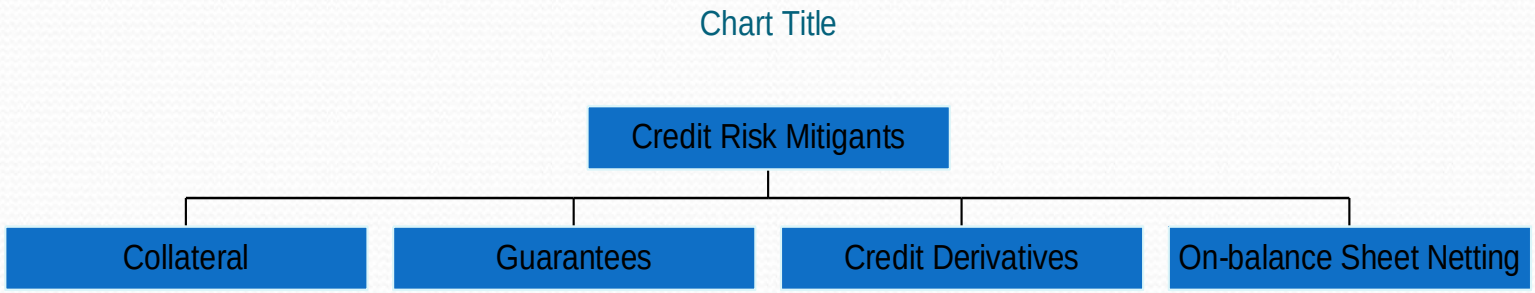
- Regulators welcome the use of credit risk models as part of internal risk management process to manage risk
- Regulators will recognize the use of credit risk models as part of their supervisory review process

VII.

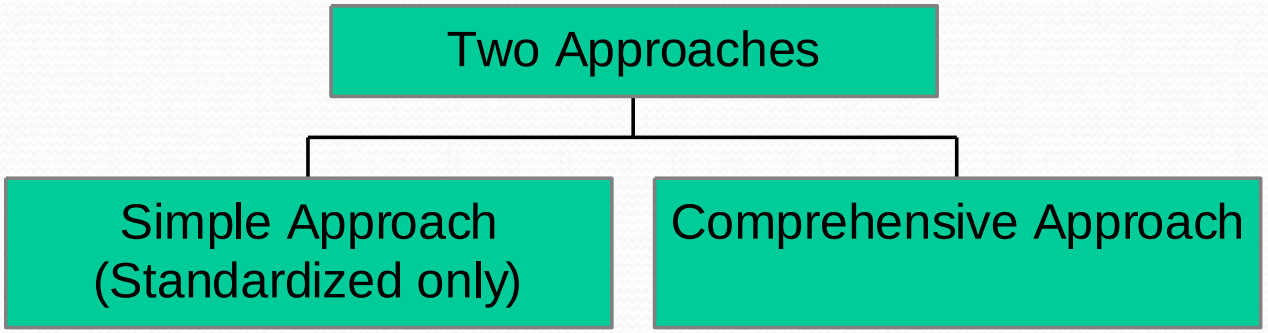
Credit Risk Mitigation

Credit Risk Mitigation

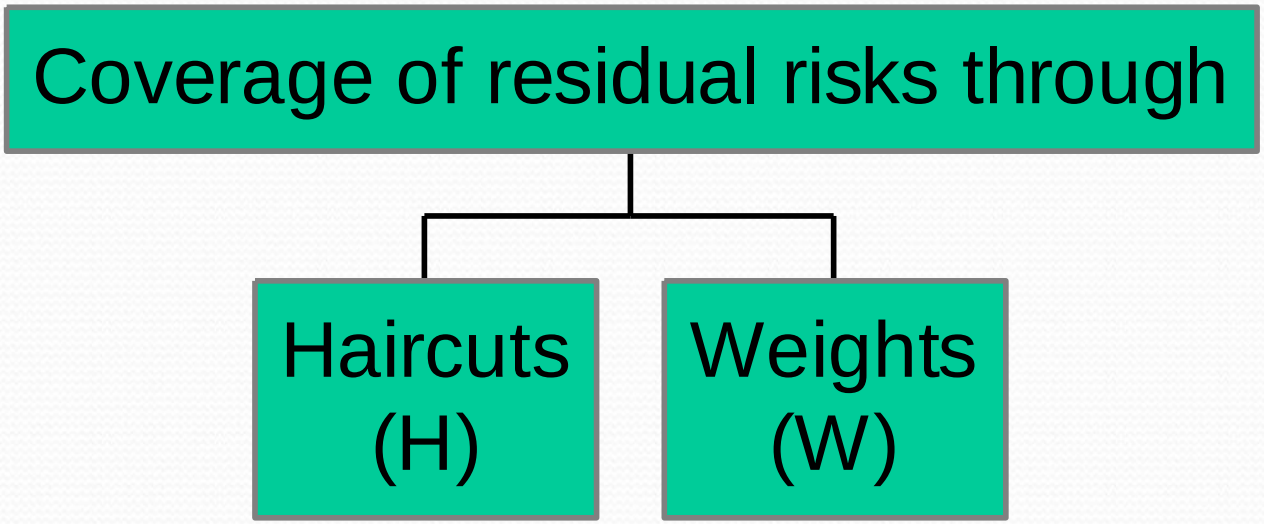
- Recognition of wider range of mitigants
- Subject to meeting minimum requirements
- Applies to both Standardized and IRB Approaches



Collateral


Two Approaches
Simple Approach
(Standardized only)
Comprehensive Approach

Collateral Comprehensive Approach



Collateral Comprehensive Approach

- *H* - should reflect the volatility of the collateral

- *w* - should reflect legal uncertainty and other residual risks.

  Represents a floor for capital requirements

Collateral Example

- $1,000 loan to BBB rated corporate
- $800 collateralised by bond

  issued by AAA rated bank
- Residual maturity of both: 2 years

Collateral Example Simple Approach

- Collateralized claims receive the risk weight applicable to the collateral instrument, subject to a floor of 20%
- Example: $1,000 - $800 = $200
- $200 x $100% = $200
- $800 x $20% = $160
- Risk Weighted Assets: $200+$160 = $360

Collateral Example Comprehensive Approach

$$C_A = \frac{C}{1 + H_E + H_C} = \frac{\$800}{1 + .04 + .06} = \$770$$

- C = Current value of the collateral received (e.g. $800)
- H_E = Haircut appropriate to the exposure (e.g.= 6%)
- H_C = Haircut appropriate for the collateral received (e.g.= 4%)
- C_A = Adjusted value of the collateral (e.g. $770)

Collateral Example Comprehensive Approach

- Calculation of risk weighted assets based on following formula:

$$r^* \times E = r \times [E-(1-w) \times C_A]$$

Collateral Example
Comprehensive Approach

- r^* = Risk weight of the position taking into account the risk reduction (e.g. 34.5%)
- w^1 = 0.15
- r = Risk weight of uncollateralized exposure (e.g. 100%)
- E = Value of the uncollateralized exposure (e.g. $1000)
- Risk Weighted Assets

  34.5% x $1,000 = 100% x [$1,000 - (1-0.15) x $770] = $345

Note: 1 Discussions ongoing with BIS re double counting of *w* factor with Operational Risk

Collateral Example Comprehensive Approach

$$C_A = \$770 = \frac{\$800}{1 + 0.04 + 0.06}$$

- Risk Weighted Assets

  34.5% x $1,000 = 100% x [$1,000 - (1-0.15) x $770] = $345

Note: comprehensive Approach saves

Collateral Example

Simple and Comprehensive Approaches

Approach	Risk Weighted Assets	Capital Charge
No Collateral	$1000	$80.0
Simple	$360	$28.8
Comprehensive	$345	$27.6

Guarantees & Credit Derivatives

- Based on substitution approach of existing Accord
- Minimum operational requirements
- Guarantees, must be
  - Direct
  - Explicit
  - Irrevocable
  - Unconditional

Guarantee - Example

- $r^* = g + w * (r-g)$
- r^* = effective risk weight of the position
- r = risk weight of the obligor
- w = weight applied to the underlying exposure

  ($w = 0.15$ or 0 for sovereigns and banks)
- g = risk weight of the guarantor

Guarantee - Example

- $1,000 loan to BBB - rated corporate
- $1,000 guaranteed by AAA rated corporate

$r^* = 20\% + 0.15 \times (100\% - 20\%) = 32\%$

Guarantees & Credit Derivatives

- Maturity Mismatches
  - < one year will not be recognized
  - > one year

$$r^{**} = \left(1 - \frac{t}{T}\right) r + \left(\frac{t}{T}\right) r^{*}$$

Guarantees & Credit Derivatives

where

r^{**} = weight of the mismatched position

r = weight of the unhedged position

r^{*} = weight if position hedged without mismatch

t = residual maturity of the hedge

T = residual maturity of exposure

On-Balance Sheet Netting

- Netting of loans and deposits will be permitted subject to the following conditions:
  - Well-founded legal basis enforceable in each relevant jurisdiction
  - Assets and liabilities must be determinable
  - Bank monitors roll-off risks
  - Bank monitors and controls relevant exposures on a net basis

VIII.
Counterparty Risk

Contents

- Forms of credit risk and credit exposure
- Methods to measure counterparty credit exposure
  - simple add-on method
  - counterparty portfolio simulation
- Economic Capital
  - Default only perspective
  - Change in economic value perspective

Type of Credit Risk	Cause of Economic Loss
Lending Risk	Borrower defaults – an accrual (non MTM) perspective ➢ Or the loan portfolio's economic value decreases because of: – Decrease in the credit quality of the obligor. – Increase in general market spreads.
Issuer Risk (Specific Risk)	Issuer of security defaults ➢ Or the security's market value decreases because of: – Decreases in the credit quality of issuer. – Increase in general market spreads.
Counterparty Risk **Settlement Risk** **Pre-Settlement Risk**	Counterparty to trade defaults – In an exchange: you pay but don't receive. – Counterparty defaults prior to settlement and the contract (portfolio) has a positive economic value. ➢ Or the economic value of derivatives with counterparty decreases because of – Decrease in credit quality of counterparty. – Increase in general market spreads

Credit Exposure: The potential loss in the event of default, ignoring recovery value

Type of Credit Exposure	Definition of Credit Exposure to Obligor
Lending Exposure	Par Value of loan (accrual perspective)
Issuer Exposure (a.k.a. Specific Risk)	Market value of security
Pre-Settlement Exposure (PSE)	• Current and potential future replacement cost of contract or counterparty's portfolio in the event of counterparty default • Ned to take portfolio effects and risk mitigants correctly into account • Should be calculated by simulation on a portfolio basis for each counterparty • Should risk rating of obligor affect measurement of market-to-market value?

Measuring Counterparty Pre-Settlement Exposure (PSE)

Two Methods:

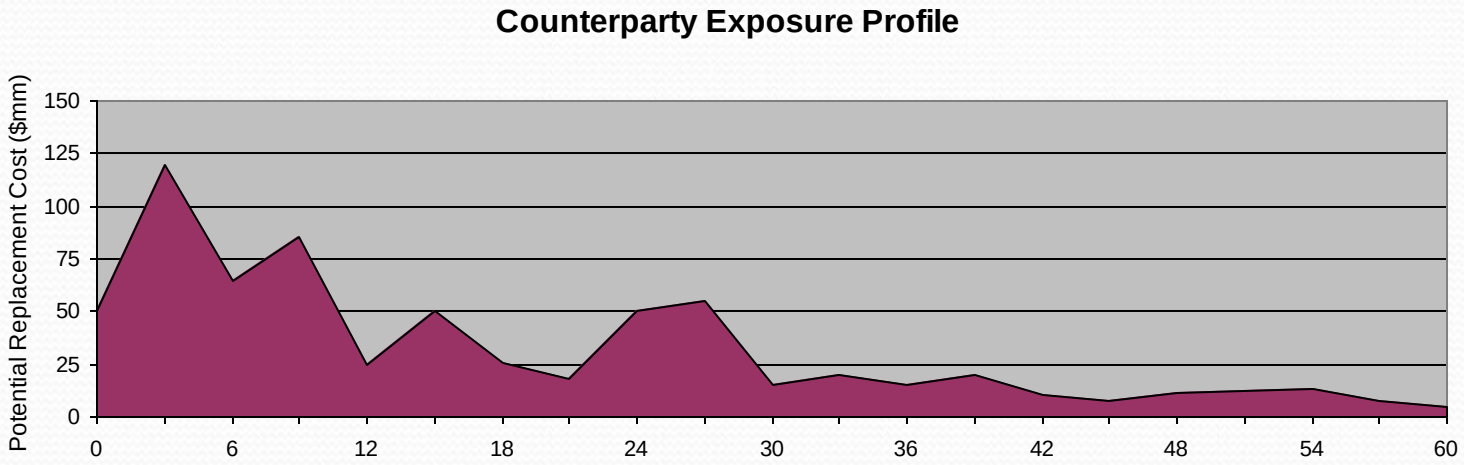
- Simple "Add On" Method

PSE = Current MTM + "Worst Case" potential increase in value

= Current MTM + Notional Principal * Credit Exposure Factor

- Portfolio Simulation Method

PSE = Exposure Profile of Counterparty



Simple "Add-On" Method

Current Replacement Cost	=	• Liquidation if positive • 0 Otherwise				
+						
Add-on amount	=	Notional amount	*	BIS add-on factor		
=						
Credit equivalent	*	Counterparty risk weighting	=	Risk-weighted amount		

Add-on Factors by Type of Underlying and Maturity

Residual maturity (%)	Interest rate (%)	Exchange rate and gold (%)	Equity (%)	Precious metals except gold (%)	Other commodities (%)
One year or less	0.0	1.0	6.0	7.0	10.0
Over one year to five years	0.5	5.0	8.0	7.0	12.0
Over five years	1.5	7.5	10.0	8.0	15.0

Illustration of the Calculation of the Add-on and risk-Weighted Amounts Including Netting

		Counterparty A			Counterparty B		
Risk capital weight (Table-3)		**20%**			**50%**		
	Add-on factor	**Notional amount**	**Market-to-market value**	**Add-on amount 1988**	**Notional amount**	**Marked-to-market Value**	**Add-on amount 1988**
Transaction 1	0.5%	1,000	400	5	700	-100	3.5
Transaction 2	1.5%	500	-200	7.5	1,000	200	15
Transaction 3	5%	1,000	-100	50	500	-200	25
Add-on amount 1988 – A1988				62.5			43.5
Gross replacement cost (GR)			400			200	
Net replacement cost (NR)			100			0 (*)	
NPR (=NR/GR)			0.25			0	
Add-on amount 1995 – A1995			34.375			17.4	
Credit equivalent			134.375			17.4	
Risk weighted amount **with netting**			26.875			8.7	
Risk weighted amount **without netting**		(400+62.5) x .2 = 92.5			(200+43.5) x .5 = 121.75		

A1995 = A1998 (0.4 + 0.6 NPR)

Credit equivalent = NR + A1995

(*) Note that “negative” replacement cost for counterparty B cannot be used to offset positive replacement costs of counterparty A. This is why it is set to zero.

Portfolio Simulation Method

Exposure Profile and Market Rate Scenarios

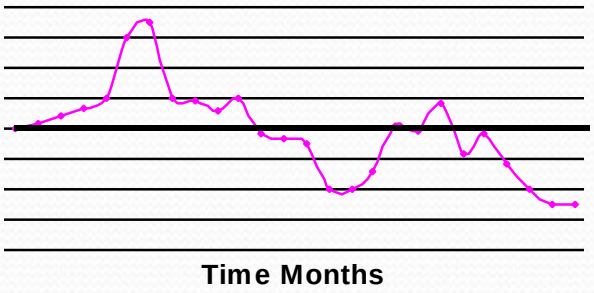
Example 1: Forward FX, we buy GBP and sell US$ for settlement in two years at 1.5000 US$/GBP.

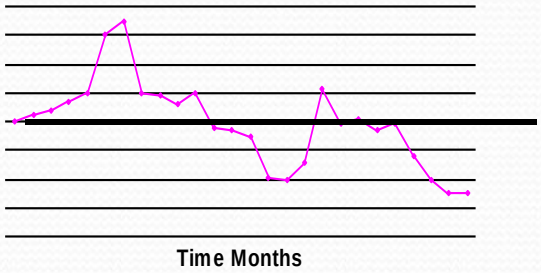
Random path of forward FX rate over life of forward transaction scenario 1.

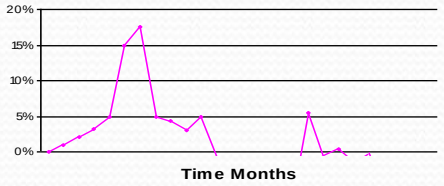
Profile of market value of forward FX transaction over its life, for scenario 1.

Exposure Profile of transaction for scenario 1.

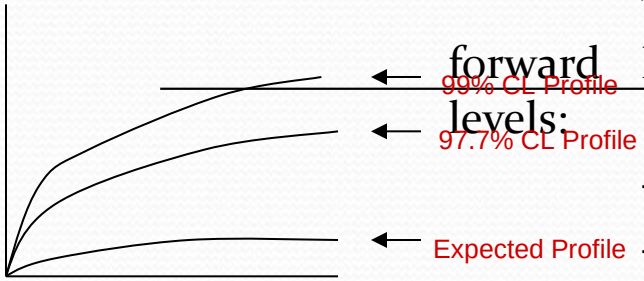
We only have exposure when the contract has a positive value to us.







Forward FX



Three Exposure Profiles for a Two year US$/GBP forward FX transaction, at three confidence levels:

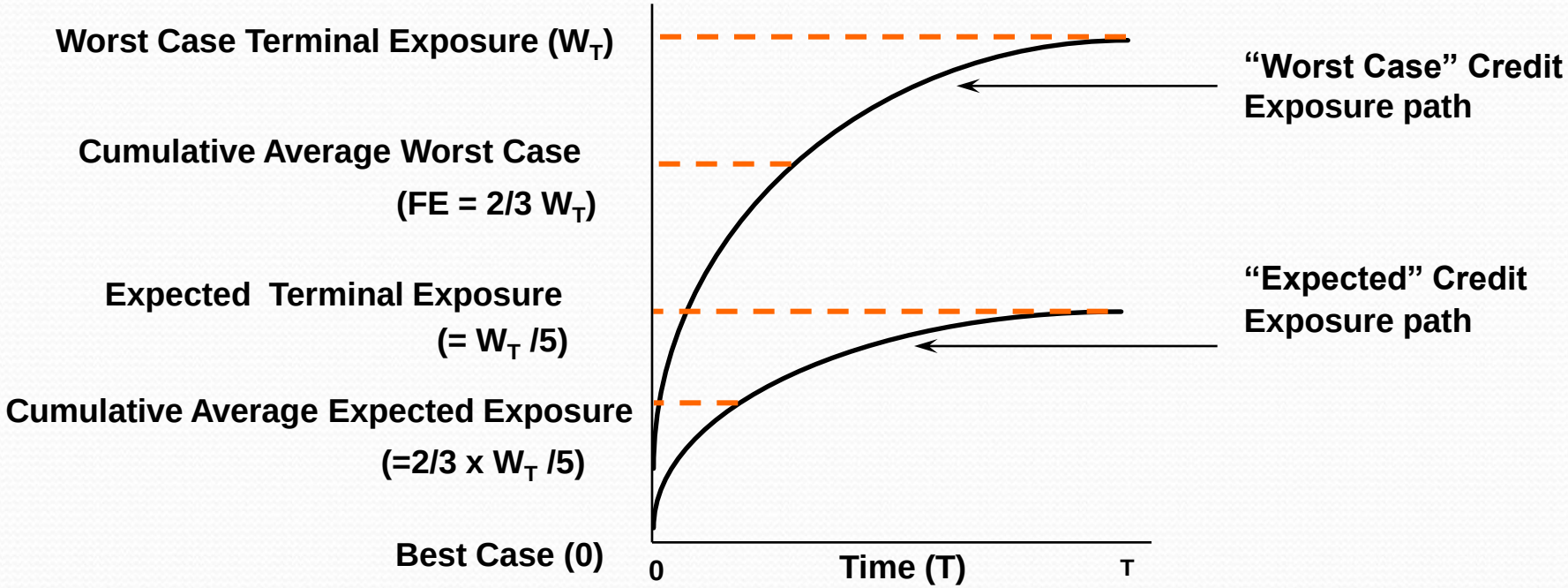
- 99% CL Exposure Profile
- 97.7% CL Exposure Profile
- Expected Exposure Profile

Interest Rate Swap

Three Exposure Profiles for a three year fixed/floating US$ interest rate swap, at three confidence levels:

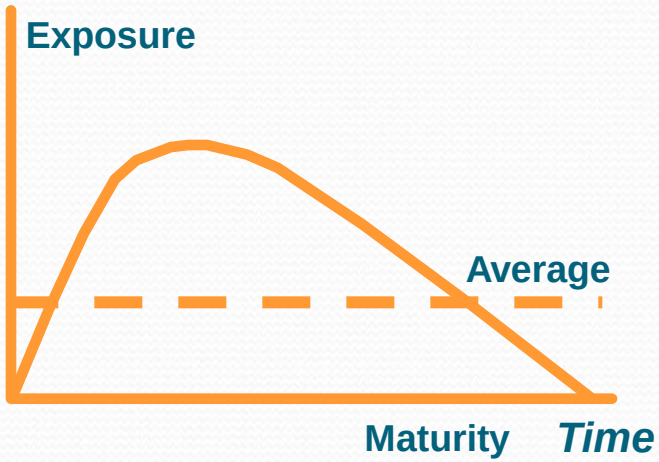
- 99% CL Exposure Profile
- 97.7 CL Exposure Profile
- Expected Exposure Profile

- Credit exposure profile for single cash flow products

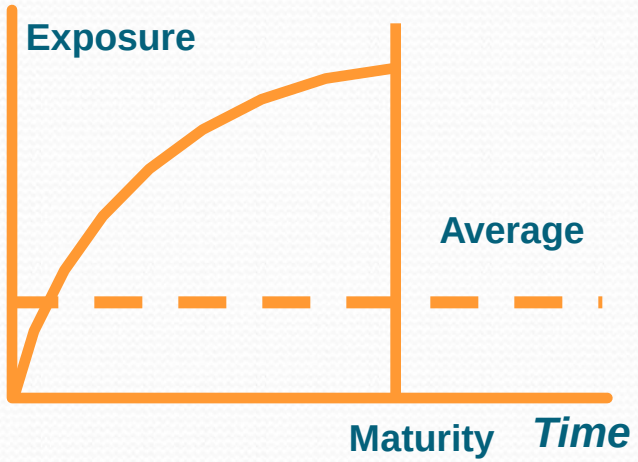


- Contingent Credit Risk - Loss Profile Over Time
  - The average of the expected replacement cost curve represents the loan equivalent

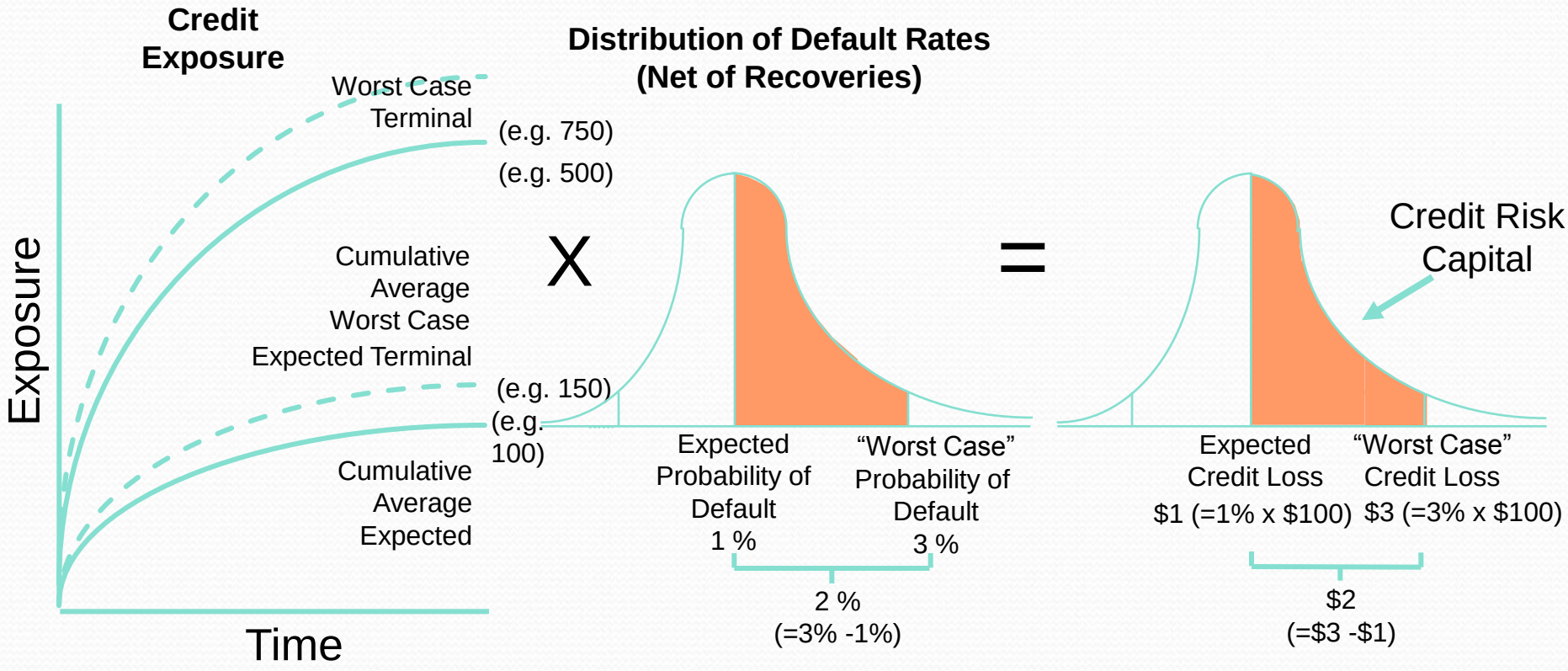
Single Currency Swap



Cross Currency Swap



- Combining credit exposure with the distribution of default rates (net of recovery) yields the distribution of credit risk losses:



Note: Assumes Capital = Unexpected Loss

Simplifying the Representation of a Transaction's potential Exposure

- The most realistic representation of a transaction's potential exposure is as an Exposure Profile.
- In the ADD ON METHOD, the transaction's exposure profile is condensed into a single number.

  PSE = Current Market Value + Potential Increase in Value.
- Choices:
  - Confidence level at which measure transaction's exposure profile.
  - Potential exposure as: Peak or Average of the transaction's exposure profile.

PSE = CMTM + "worst" case potential increase in value

= CMTM + Notional Principal * CREDIT EXPOSURE FACTOR (CEF)

MORE PRECISELY, FOR A SINGLE TRANSACTION:

PSE(t) = max[CMTM(t) + P*CEF(t,T), 0]

CEF = "worst" case potential increase in value / notional principal

- **Derived from the transaction's exposure profile, calculated at very high confidence level, by condensing potential increase in value into a single number.**
- **Profile based on historical volatilities and correlations of market rates.**
- **Rests on many simplifying assumptions.**

For standard products, tables of CEFs can be specified by:

- **Product (form of contract and primary underlying market factor)**
- **Remaining tenor until final cash settlement**
- **Volatility of underlying market factors**

For non-standard transactions, one-off calculations can be done.

CEFS ARE APPROXIMATIONS

- Representing the potential exposure of a contract as a SINGLE NUMBER VS. a TIME VARYING EXPOSURE PROFILE.

- PRECISION VS. EASE OF IMPLEMENTATION
  - Even if Potential Exposure is represented as a single number, a precise calculation of the potential increase in exposure would take into account:
    1. **The contract's specific terms and conditions**
       - Particular product
       - Buy or sell, pay or receive, call or put.
       - Non-standard terms and conditions.
    2. **Actual Market Rates**
       - Including shape of yield curve, etc.
       - Volatilities and correlations
    3. **Moneyness - Relation between (1) and (2)**

- CEF METHOD CANNOT CORRECTLY HANDLE PORTFOLIO EFFECTS

- GENERAL ISSUES APPLICABLE TO SINGLE CONTRACTS OR PORTFOLIOS
  - **Accuracy of representation of market rates.**
  - **Capturing specific terms and conditions of each contract.**
  - **Representing exposure as a profile, not a single number.**

- ISSUES SPECIFIC TO PORTFOLIOS

  Statistical factor

  Portfolio exposure tends to be less than sum of individual contract exposures.
  - **A single market rate cannot increase and decrease simultaneously.**
  - **Market rates are correlated.**

  Legal factors

  Potential reduction in exposure via contractual risk mitigating agreements:
  - **Netting Agreements.**
  - **Margin Agreements (affects exposures of both single contract and portfolio).**
  - **Options to early termination agreements (affects both single contract and portfolio).**

General Method: Four Steps

1. Simulate changes in market rates Over Time.
   - **Start with current market rates.**
   - **Simulate scenarios (or paths) of changes in market rates at many future dates, over many years, using tables of volatilities and correlations.**

2. For each simulated scenario, measure potential market value of each transaction over time.
   - **Start with feed of transaction details and legal information.**
   - **For each simulated scenario, calculate the potential market value of each contract at many future dates, using the contract's terms and conditions, revaluation formula and the simulated state of the market.**

3. For each simulated scenario, measure counterparty's potential exposure over time.
   - **For each simulated scenario, at each future point in time, transform the potential market value of each contract into the potential exposure of the portfolio through aggregation rules that take risk mitigants and legal context into account.**

4. At each forward point in time, calculate potential exposure at some high confidence level

	Market Risk	Pre-Settlement Exposure
Risk:	Fall in economic value	Default when positive value
Time Horizon	Very short • Usually overnight • Usually static portfolio	Long Term • Usually, life of portfolio • Need to model potential future cash flows over time
Legal Issues	Usually irrelevant	Crucially relevant

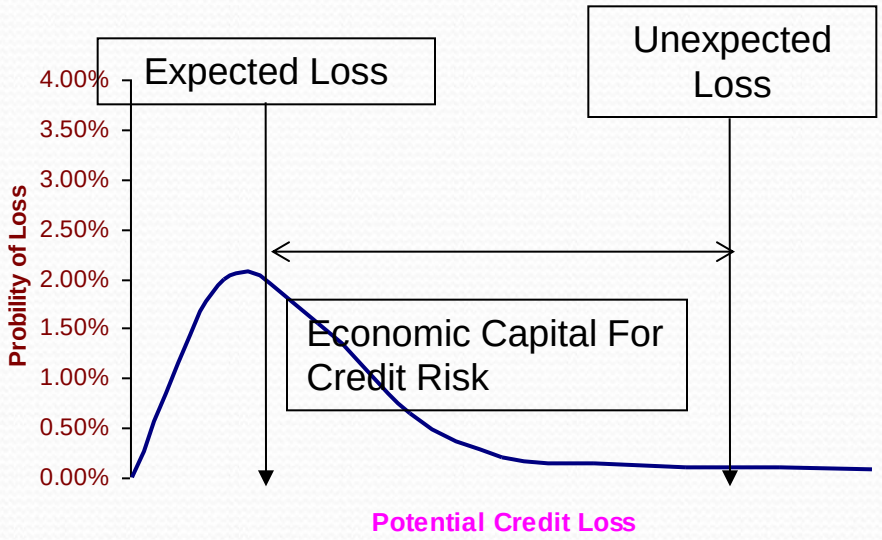
ECONOMIC CAPITAL

Statistical Measure of Potential Credit Loss

Minimum Return for Credit Risk = Expected Loss + cost of economic capital

Economic Capital for Credit Loss = A "cushion" to absorb unexpected losses,at a high confidence level, in excess of the expected loss

Probability Distribution of Potential Credit Loss (hypothetical) for a set of obligors



The probability distribution of potential credit loss depends on the definition of credit loss.

Importance of Definition of Credit Loss

The PROBABILITY DISTRIBUTION of potential loss depends on:

The Definition of Loss

- **Accounting basics**
  - e.g. default only vs. economic loss
- **The type of risks(s) which give rise to loss**
  - e.g. issuer risk,pre-settlement credit risk or any credit event
- **The time horizon over which economic loss could occur (e.g. one year)**

THE STATISTICAL PARAMETERS used to simulate potential loss

ECONOMIC CAPITAL will depend on:

The probability distribution of loss and

The confidence level (e.g. 99.9%, 99.97%) at which EC is measured

Simulating Loss Distribution of Loan Portfolio: Default Only Analysis

ASSUME ONLY SOURCE OF CREDIT RISK IS DEFAULT

FACTORS NEEDED TO SIMULATE LOSS DISTRIBUTION:

- **Credit Exposure per Obligor**
- **Probability of Default (by risk rating, industry, etc.) and correlations of probability of default**
- **Probability distribution of Loss in the Event of Default (LIED) (a.k.a. LGD)**

Economic Capital

Factors affecting the width of distribution of potential credit loss for default only analysis:

- **Statistical uncertainty in how many obligors will default - even if risk ratings, default probabilities and correlations of default were precisely known**
- **Uncertainty in which obligors default - important for an inhomogeneous book**
- **Uncertainty in credit exposure at default**
- **Uncertainty in loss in the event of default**
- **Uncertainty in assumptions/data**
  - **risk assessment of obligors**
    - lack of transparency and lack of standardization of financial information.
  - Uncertainty in probability of default (e.g. effect of uncertain future economic conditions).
  - Uncertainty in correlations of default

TWO PORTFOLIOS WITH CREDIT RISK COULD HAVE IDENTICAL EXPECTED LOSSES AND VASTLY DIFFERENT UNEXPECTED LOSSES.

Simulating Loss Distribution of Loan Portfolio: Full Economic Analysis

Factors needed for simulation:

- **Credit Exposure** (particularly important for counterparty risk)
- Volatilities and correlations of changes in **general credit spreads** (by risk rating, industry etc.)
- **Migration of risk rating** of individual obligors and **correlations** of migration.
- **Probability of default** (by risk rating industry, etc.) and **correlations** of probability of default.
- Probablity distribution of **Loss in the Event of Default** (LIED)

IX.
Operational Risk

Operational Risk

- Definition:
  - Risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems of external events
  - Excludes “Business Risk” and “Strategic Risk”
- Spectrum of approaches
  - Basic indicator - based on a single indicator
  - Standardized approach - divides banks’ activities into a number of standardized industry business lines
  - Internal measurement approach
- Approximately 20% current capital charge

CIBC Operational Risk Losses Types

1. Legal Liability:

   inludes client, employee and other third party law suits

2 . Regulatory, Compliance and Taxation Penalties:

   fines, or the cost of any other penalties, such as license revocations and associated costs - excludes lost / forgone revenue.

3 . Loss of or Damage to Assets:

   reduction in value of the firm's non-financial asset and property

4 . Client Restitution:

   includes restitution payments (principal and/or interest) or other compensation to clients.

5 . Theft, Fraud and Unauthorized Activities:

   includes rogue trading

6. Transaction Processing Risk:

   includes failed or late settlement, wrong amount or wrong counterparty

The Regulatory Approach:Four Increasingly Risk Sensitive Approaches

Risk Based/ less Regulatory Capital:

Basic Indicator

Bank	Rate / Base

Standardized

Standardized Approach

Bank	
LOB1	β_1 / EI_1
LOB2	β_2 / EI_2
LOB3	
•	
•	
•	
LOBn	β_N / EI_N

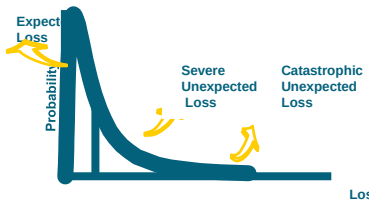
Internal Measurement Approach

Internal Measurement Approach

Bank	Risk Type 1	• • •	Risk Type 6
LOB1	Rate 1 / EI_1		$Rate_1$ / Base
LOB2	Rate 2 / EI_2		$Rate_2$ / Base
LOB3	Base		Base
•	•		•
•	•		•
•	•		•
LOBn	$Rate_N$ / EI_N		$Rate_N$ / Base

Loss Distribution

Loss Distribution Approach



Rate of progression between stages based on necessity and capability

Operational Risk - Basic Indicator Approach

- Capital requirement = α% of gross income

- Gross income = Net interest income

  +

  Net non-interest income

Note: α supplied by BIS (currently α = 30%)

Operational Risk - Standardized Approach

- Banks' activities are divided into standardized business lines.
- Within each business line:
  - specific indicator reflecting size of activity in that area
  - Capital charge$_i$ = β_i x exposure indicator$_i$
- Overall capital requirement =

  sum of requirements for each business line

Operational Risk - Standardized Approach

Example

Business Lines	Exposure Indicator (EI)	Capital Factors[1]
Corporate Finance	Gross Income	β_1
Trading and Sales	Gross Income (or VaR)	β_2
Retail Banking	Annual Average Assets	β_3
Commercial Banking	Annual Average Assets	β_4
Payment and Settlement	Annual Settlement Throughput	β_5
Retail Brokerage	Gross Income	β_6
Asset Management	Total Funds under Management	β_7

Note: [1] Definition of exposure indicator and B_i will be supplied by BIS

Operational Risk - Internal Measurement Approach

- Based on the same business lines as standardized approach
- Supervisor specifies an exposure indicator (EI)
- Bank measures, based on internal loss data,
  - Parameter representing probability of loss event (PE)
  - Parameter representing loss given that event (LGE)
- Supervisor supplies a factor (gamma) for each business line

The Internal Measurement Approach

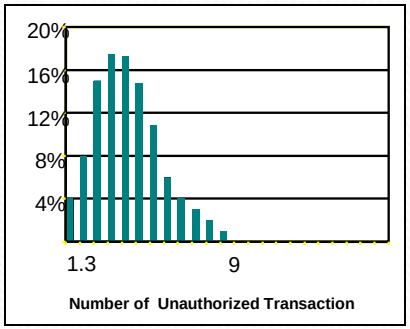
For a line of business and loss type

$$\text{Op Risk Capital (OpVaR)} = EI_{LOB} \times PE_{LOB} \times \underbrace{LGE_{LOB} \times \gamma_{industry}}_{LR_{firm}} \times \overbrace{RPI_{LOB}}^{\text{Rate}}$$

EI	=	Exposure Index - e.g. no of transactions * average value of transaction
PE	=	Expected Probability of an operational risk event (number of loss events / number of transactions)
LGE	=	Average Loss Rate per event - average loss/ average value of transaction
LR	=	Loss Rate (PE x LGE)
γ	=	Factor to convert the expected loss to unexpected loss
RPI	=	Adjusts for the non-linear relationship between EI and OpVar (RPI = Risk Profile Index)

The Components of OP VaR

e.g. VISA Per $100 transaction



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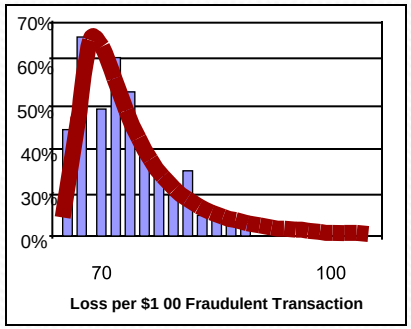

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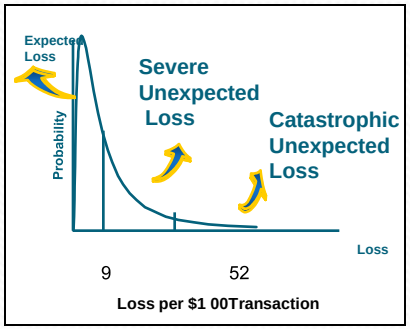


The Probability Distribution

Eg; on average 1.3 transaction per 1,000 (PE) are fraudulent

Note: worst case is 9

The Severity Distribution

Eg; on average 70% (LGE) of the value of the transaction have to be written off

Note: worst case is 100

The Loss Distribution

Eg; on average 9 cents per $100 of transaction (LR)

Note: worst case is 52

Example - Basic Indicator Approach

Basic Indicator		Captial Factor α	OpVar
Gross Income	$10 b	30%	$3 b

Example - Standardized Approach

Business Lines	Indicator	Capital Factors (β)[1]		OpVar
Corporate Finance	$2.7 b Gross Income	7%	=	$184 mm
Trading and Sales	$1.5 mm Gross Income	33%	=	$503 mm
Retail Banking	$105 b Annual Average Assets	1%	=	$1,185 mm
Commercial Banking	$13 b Annual Average Assets	0.4 %	=	$55 mm
Payment and Settlement	$6.25 b Annual Settlement Throughput	0.002%	=	$116 mm
Retail Brokerage	$281 mm Gross Income	10%	=	$28 mm
Asset Management	$196 b Total Funds under Mgmt	0.066%	=	$129 mm
		Total	=	$2,200 mm[2]

Note:

1. β's not yet established by BIS
2. Total across businesses does not allow for diversification effect

Example - Internal Measurement Approach

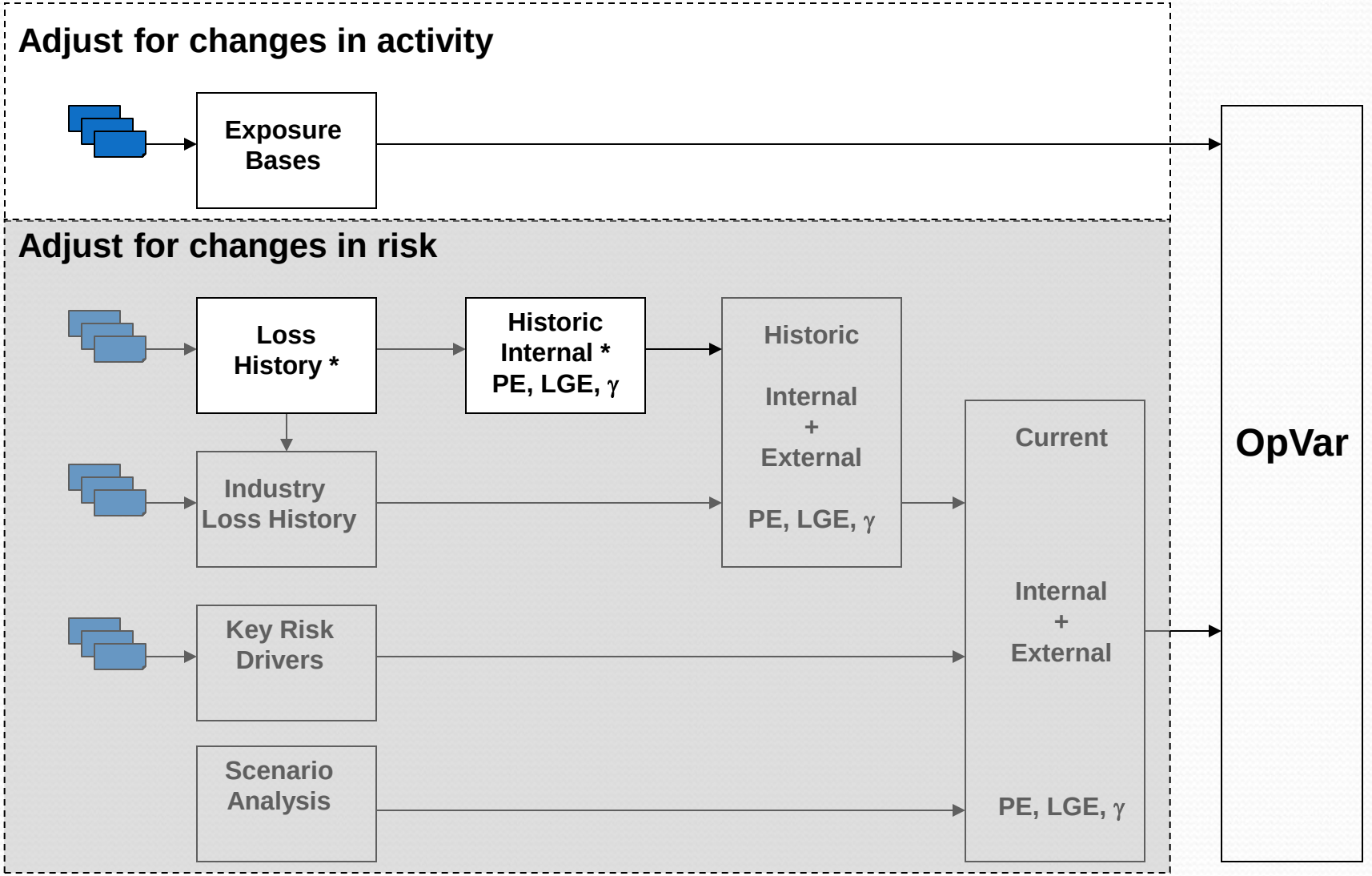
Business Line (LOB): Credit Derivatives

		Exposure Indicator (EI)						
Risk Type	Loss Type[1]	Number	Avg. Rate	PE (Basis Points)	LGE	Gamma γ	RPI	OpVaR
1	Legal Liability	60	$32 mm	33	2.9%	43	1.3	$10.4 mm
2	Reg. Comp. / Tax Fines or Penalties	378	$68 mm	5	0.8%	49	1.6	$8.5 mm
4	Client Restitution	60	$32 mm	33	0.3%	25	1.4	$0.7 mm
5	Theft/Fraud & Unauthorized Activity	378	$68 mm	5	1.0%	27	1.6	$5.7 mm
6.	Transaction Risk	378	$68 mm	5	2.7%	18	1.6	$10.5 mm
							Total	**$35.8 mm[2]**

Note:

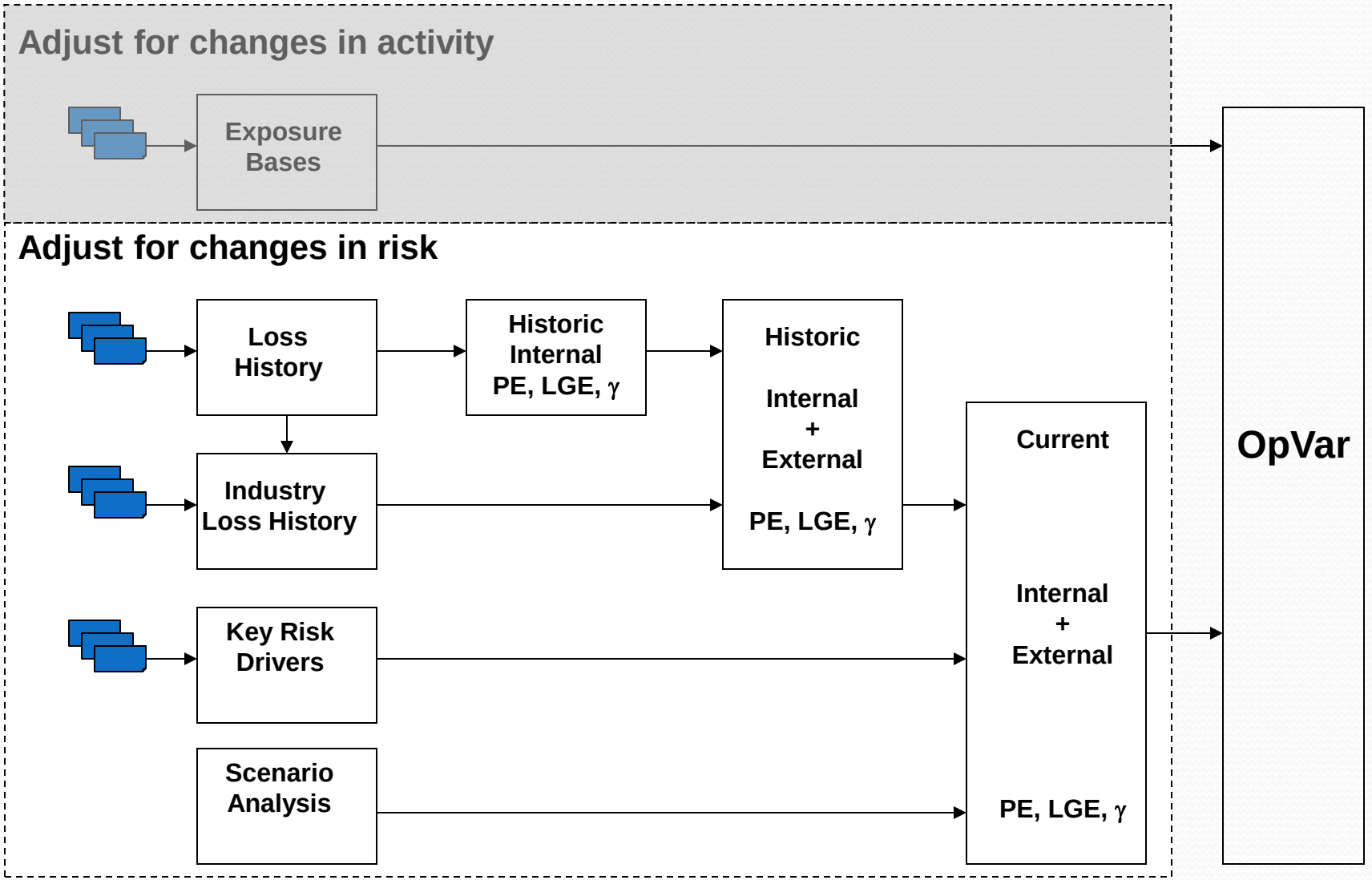
1. Loss on damage to assets not applicable to this LOB
2. Assume full benefit of diversification within a LOB

OpVar Process - Short Term



* adjust rates where sufficient internal data is available

OpVar Process - Longer term



X.

Appendix

1. Risk Weight for Corporate Exposure

Operational Risk Related:

2. Operational Risk's Loss Types
3. Exposure Base, PE, LGE
4. Eligibility Criteria for IMA
5. Operational Risk Disclosures: Pillar 3

6. Book announcement: Risk Management
   by M. Crouhy, D. Galai and R. Mark

Risk Weight for Corporate Exposure

$$RW_C = (LGD/50) * BRW_C(PD) * [1 + b(PD) * (M - 3)]$$

or $(12.5 * LGD)$ whichever is smaller.

$BRW_C(PD) =$ **Corporate benchmark risk weight**:

$$976.5 * N(1.118 * G(PD) + 1.288) * (1 + .0470 * (1 - PD) / PD^{0.44})^{10}$$

PD = probability of default

M = maturity

$$b(PD) = \frac{0.235 * (1 - PD)}{PD^{0.44} + .0470 * (1 - PD)}^{1}$$

N(x) = cumulative normal distribution

G(z) = inverse cumulative normal distribution

[1] **PD is expressed as a decimal (e.g., 0.01 for 1 percent)**

- N(1.118xG(PD)+1.288) = sum of expected and unexpected losses associated with a hypothetical, infinitely-granular portfolio of one-year loan having an LGD of 100%, using a so-called Merton-style credit risk model in which there is a single systematic risk factor and the values of borrowers' assets are assumed lognormally distributed, a confidence level of 99.5% and an average correlation of 20%
- The term $(1+.0470x(1-PD)/PD^{0.44})$ is an adjustment to reflect that the IRB benchmark risk weights are calibrated to a 3-year average maturity; and the scaling factor 976.5, which is calibrated so that the IRB benchmark risk weight equals 100% for values of PD and LGD equal to 0.7% and 50% respectively.

Maturity Adjustments to The Risk Weights, Derived From MTM-models

	Maturity Adjustments			
PD(%)	1 Year	3 Years	5 Years	7 Years
0.03	0.4	1.0	1.6	2.3
0.05	0.4	1.0	1.6	2.1
0.10	0.5	1.0	1.5	2.0
0.20	0.6	1.0	1.4	1.8
0.50	0.7	1.0	1.3	1.6
1.00	0.7	1.0	1.3	1.5
1.40	0.8	1.0	1.2	1.5
3.30	0.8	1.0	1.2	1.3
6.60	0.9	1.0	1.1	1.3
15.0	0.9	1.0	1.1	1.2

CIBC Operational Risk Loss Types

1. Legal Liability

- ☐ Employee*
  - ☐ Wrongful termination
  - ☐ Discrimination
  - ☐ Workplace safety
  - ☐ Privacy violation
- ☐ Client *
  - ☐ Fiduciary breaches/guidelines
  - ☐ Suitability/ disclosure
  - ☐ Account churning
  - ☐ Aggressive sales
  - ☐ Violation of confidentiality
  - ☐ Lender liability
- ☐ Third Party *
  - ☐ Copyright/patent /license infringement
  - ☐ Supplier lawsuits

2. Regulatory, Compliance and Taxation Penalties *

- ☐ Failure to comply with regulations
- ☐ Money laundering
- ☐ Tax non compliance
- ☐ Market manipulation
- ☐ Insider trading
- ☐ Bribes

3. Loss or Damage to Assets *

- ☐ Damage to
  - ☐ buildings
  - ☐ equipment
  - ☐ physical certificates
  - ☐ physical commodities holdings (eg gold)
  - ☐ records

4. Client Restitution *

- ☐ Goodwill payments
- ☐ Payments to make client whole

5. Theft, Fraud, Unauthorized Activities

- ☐ Theft/ Fraud *
  - ☐ Defalcation
  - ☐ Forged Cheques
  - ☐ Worthless deposits
  - ☐ Counterfeit cheques
  - ☐ Account takeover
  - ☐ Robbery
  - ☐ Kiting
  - ☐ Misappropriations of assets
  - ☐ Credit card fraud
- ☐ Unauthorized Activity *
  - ☐ lending/trading above limits
  - ☐ intentional mismarking of positions
  - ☐ unlicensed activity
  - ☐ hiding trades/ loans
  - ☐ unapproved account access

6. Transaction Processing Risk *

- ☐ Data entry errors
- ☐ Delivery failure
- ☐ Collateral management failure
- ☐ Incomplete legal documents
- ☐ Reporting errors
- ☐ Calculation errors
- ☐ Wrong delivery
- ☐ Wrong payment amount
- ☐ Cash shortages
- ☐ Missing or disputed cheques

* indicates the level at which Op VaR is calculated for each business line

CIBC Operational Risk EI, PE, LGE

		LR = PE x LGE	
	EI (Base)	**PE**	**LGE**
1.	**Legal Liability:** Client No of clients * Av Bal. Per client Employee No of employee * Av Comp	 No of lawsuits/no of clients No of lawsuits/no of employees	 Av loss/Av bal. Per client Av loss/Av Comp
2.	**Regulatory, Compliance and Taxation Penalties:** No of physical assets * Av value	No of penalties[1]/no of accounts	Av penalty[1]/Av balance per acc't
3.	**Loss of, or Damage to Assets:** No physical assets * Av value	No of damages/no of phy. assets	Av loss/Av value of phy. assets
4.	**Client Restitution** No of accounts * Av bal. Per account	No of restitutions/no of accounts	Av restitution/Av bal per account
5.	**Theft, Fraud and Unauthorized Activities** No of accounts * Av bal. per account Or No of transaction & Av value per trans.	 No of frauds/no of accounts No of frauds/no of transactions	 Av loss/Av balance per account Av loss/Av value per transaction
6.	**Transaction Processing Risk** No of transaction * Av value per transaction	No of errors/No of transaction	Av loss/Av value per transaction

[1] includes cost to comply

Eligibility Criteria: for IMA

IMA	• Active involvement of board and senior management.
Effective Risk Management and Control	• Independent operational risk management and control process covering design, implementation and review of measurement methodology. • Internal Audit Groups conduct regular reviews of management process and measurement methodology. • Documentation of risk management systems. • Bank must use data for risk reporting, management reporting, capital allocation, risk analysis, etc.

Eligibility Criteria: for IMA

IMA	• Appropriate risk reporting systems to generate aggregate data used in capital calculation.
Measurement and Validation	• Construct management reporting based on results. • Systematically tract relevant operational risk data • Sound internal loss and event reporting practices supported by loss database systems. • Regular validation of loss rates, risk indicators and size estimations, supplemented with external data. • Regular scenario analysis and stress testing. • Supervisors must examine the data collection, measurement, validation process and assess the appropriateness of the operational risk control environment.

Operational Risk Disclosure: Pillar 3

1) The approach a bank qualifies for (i.e. IMA)

2) Key elements of operational risk management framework including information about the following:
   a) risk policies
   b) organizational structure
   c) risk reporting system
   d) documentation of risk management procedures
   e) effective use of an information system
   f) organization (reporting framework) and responsibilities of an independent risk control unit
   g) independent reviews of the risk management systems at least annually
   h) involvement of board and senior management in taking responsibility for operational risk; and
   i) any operational risk mitigation techniques used

3) Operational risk exposure by business line (a proxy for the risk exposure is the capital charge).