Tools for Effective Enterprise-Wide Risk Management

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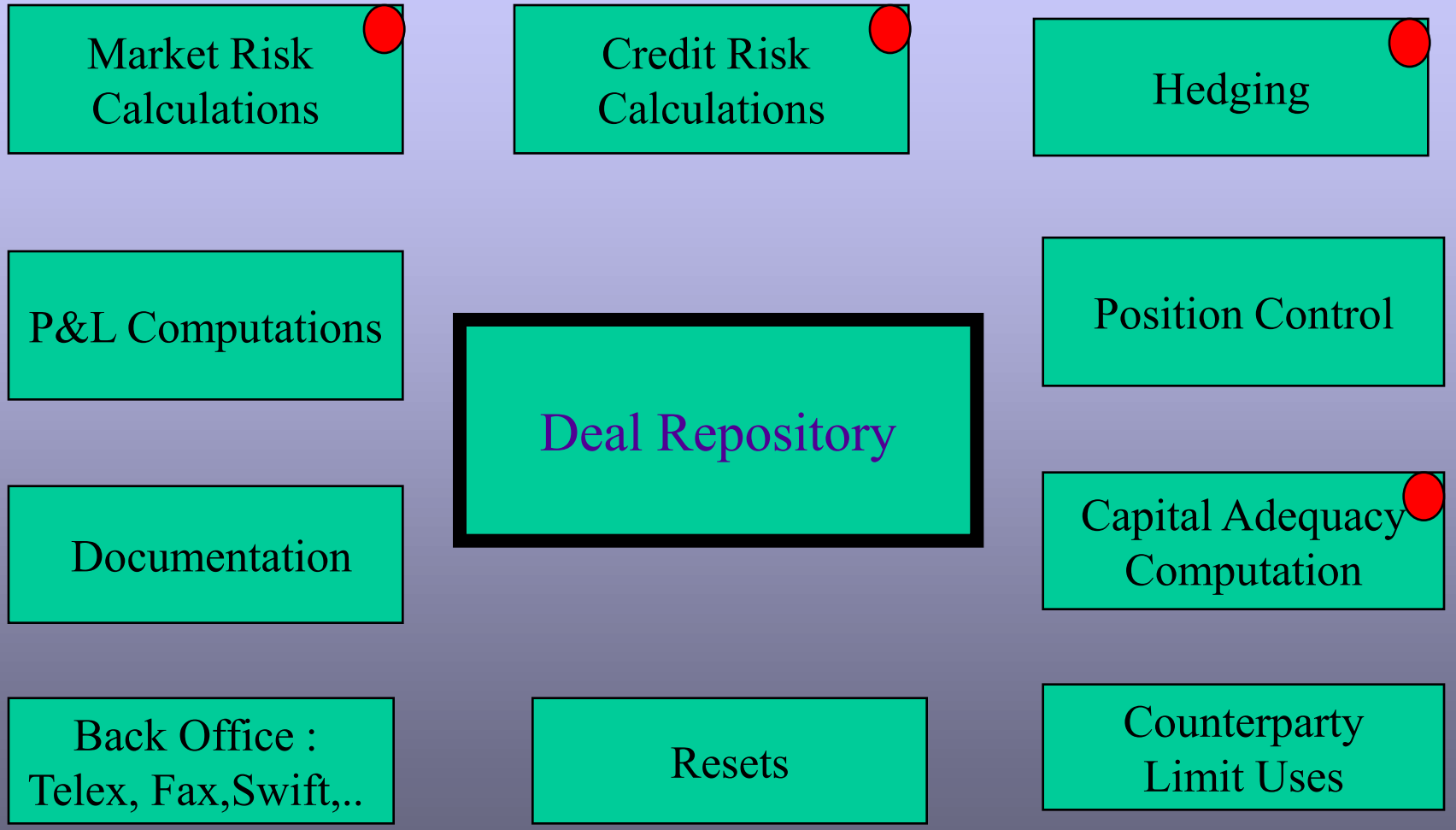
Overview

- Firmwide Risks and Hedges
- Natural Risk Descriptors, Standardized Risk Descriptors, Model Descriptors.
- Unifying Credit Risks and Market Risk
- Conclusion

The Deal Repository Central Database

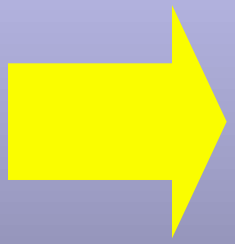


Computationally Intensive Tasks

Deal Descriptions

Portfolios Specifications

Market Conditions



Mark To Market
Sensitivities calculations

Stress Testing

Operational Hedge Ratios

Optimal Hedge Ratios
Uses Of Limits

Credit Risk Computations

Historical VaR

Monte Carlo VaR

Back Testing

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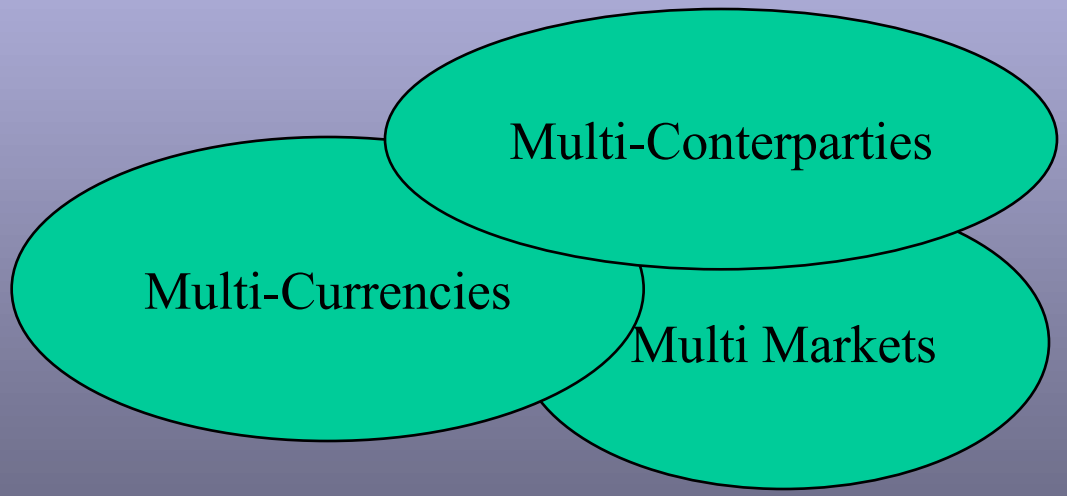
Worldwide Net of Risk Sources

Diversely documented position sheet

Inconsistent mark to market

Complexity of the structured deals

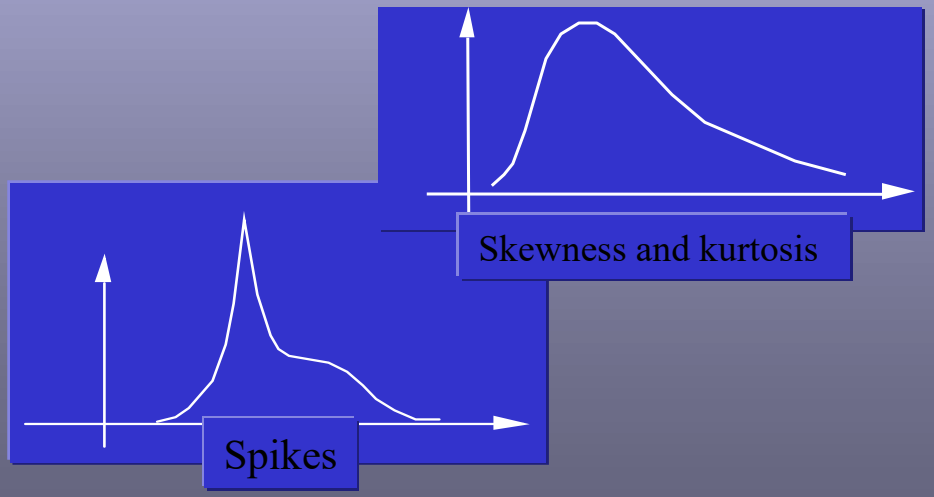
Diversity and inconsistency of the models

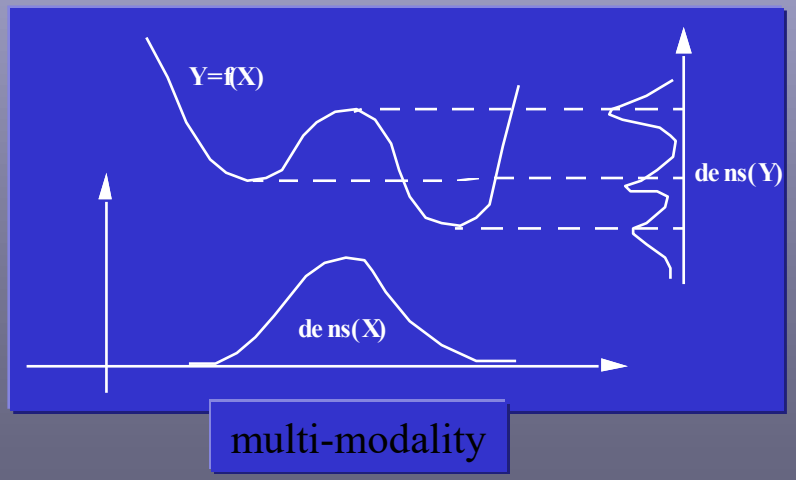


What to aggregate ?
How to aggregate ?

Difficulties Associated with Real Portfolios Distributions

- **Skewness and kurtosis**
  - Risk of buying and option # Risk of selling an option
- **Spikes in the density**
  - High gamma without corresponding delta : infinite density
- **Multi modality**
  - Non Local effects (pile of option spreads)





Risk Methodologies

- **Probabilistic methods**
  - Monte Carlo calculation
  - Historical simulation -> no covariance matrix
  - First order sensitivities based risk computations
- **Non probabilistic methods**
  - Worst case analysis
  - Preferred (customized) scenarios based analysis
  - Standard risk calculation (legal, margin call,..)
- **Improved Methods**
  - Randomized quasi Monte-Carlo : improves the convergence
  - Enhanced historical methods : increases the number of points
  - Second order sensitivities based risk computations

Where do I need Risk and Hedges calculations ?

- **On the trading desk :**
  - Hedges allow me to take only the desired risks -> risk engineering
  - Risks calculations allow me to checks my limits
- **At the level of the trading floor**
  - Risk calculations and P&L should be an important element in the determination of the bonuses
  - Risk calculations allow to spot non profitable risky activities
- **At the level of the bank**
  - Risk calculations allow me to link capital requirement and limits policy
  - Risk calculations allow to monitor any suspect risk taking (internal audit)

Hedge Ratios

A Bond Option → Black & Scholes (Fut(Bond) , other param.)

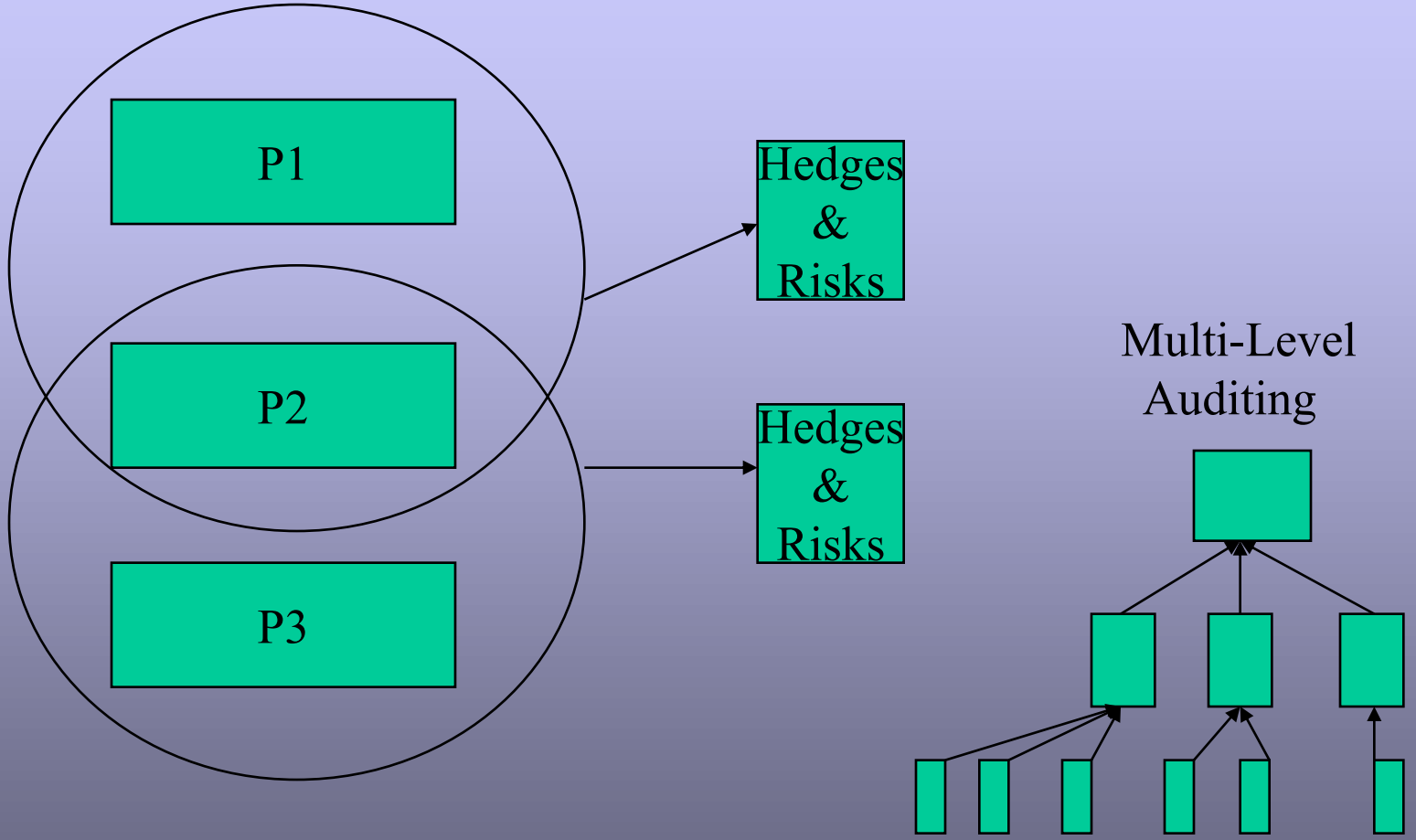
$$\text{Hedge Ratio} = \frac{\partial \text{ Black (Fut(Bond) , other param.)}}{\partial \text{ Fut(Bond)}}$$

$$\Delta_{Option} = \begin{pmatrix} a_1 \\ a_2 \\ \dots \\ a_n \end{pmatrix} \quad \Delta_{Futur} = \begin{pmatrix} b_1 \\ b_2 \\ \dots \\ b_n \end{pmatrix} \quad \text{Hedge Ratio} = \frac{\Delta_{Option} \cdot \Delta_{Futur}}{\|\Delta_{Futur}\|^2}$$

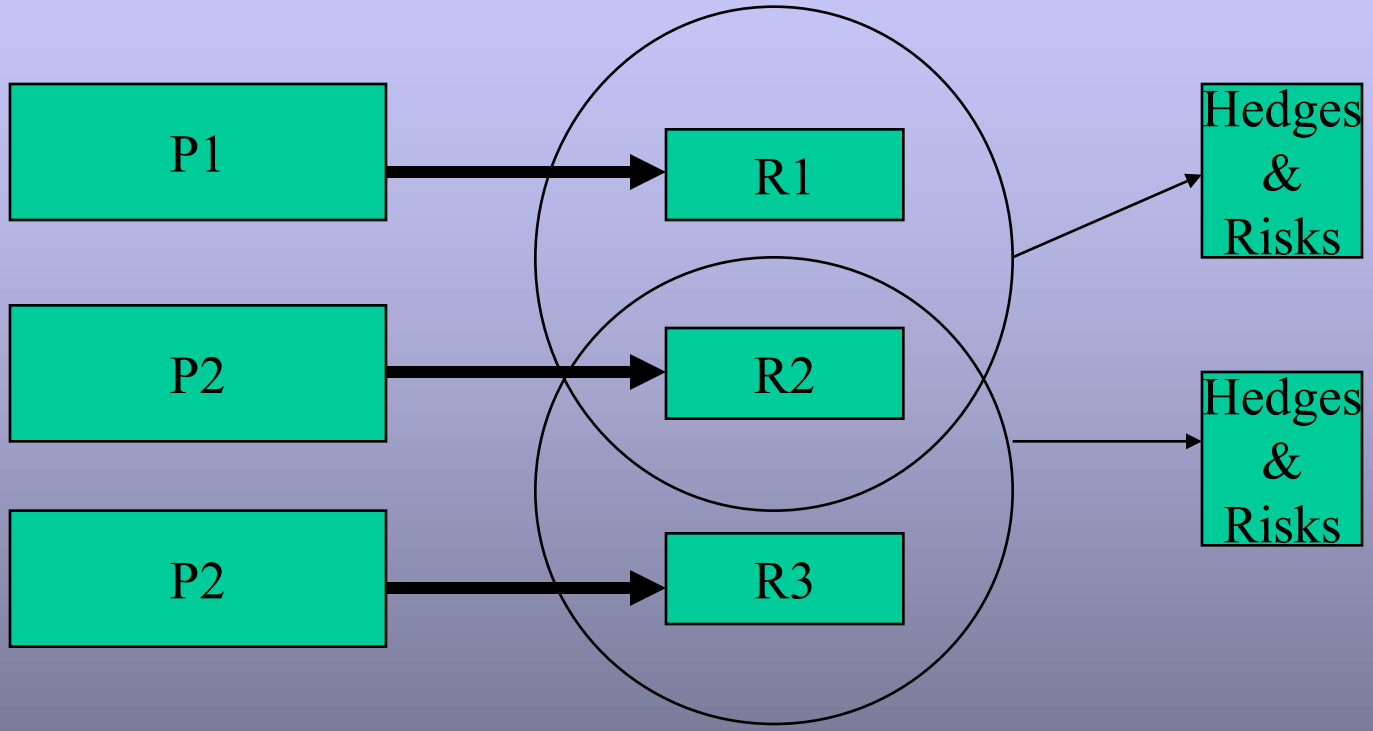
$$\text{Hedge Ratio} = \text{Min} \left\| (\Delta_{Option} - h \times \Delta_{Futur}) \Big|_{\{\Delta_{Futur}\}} \right\|$$

- $h_1\Delta_1 + h_2\Delta_2 + \dots$ — Multi-hedges
- $\{r_{6m}, r_{1y}, r_{2y}, \dots\}$ — Other dimensions
- $\Delta^t C \Delta$ — Correlations, non linear, non local

Need for Aggregations

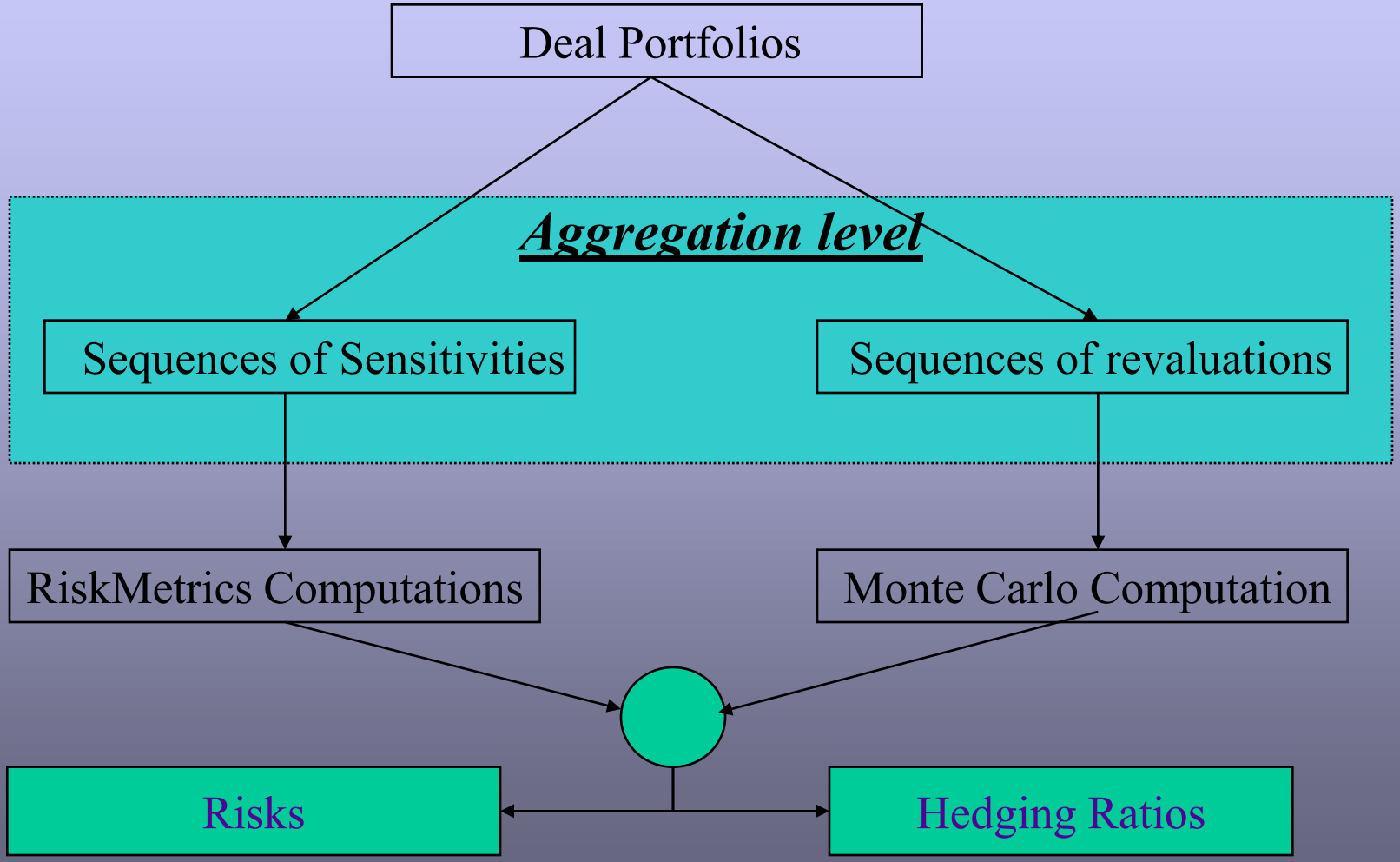


Risk Descriptors

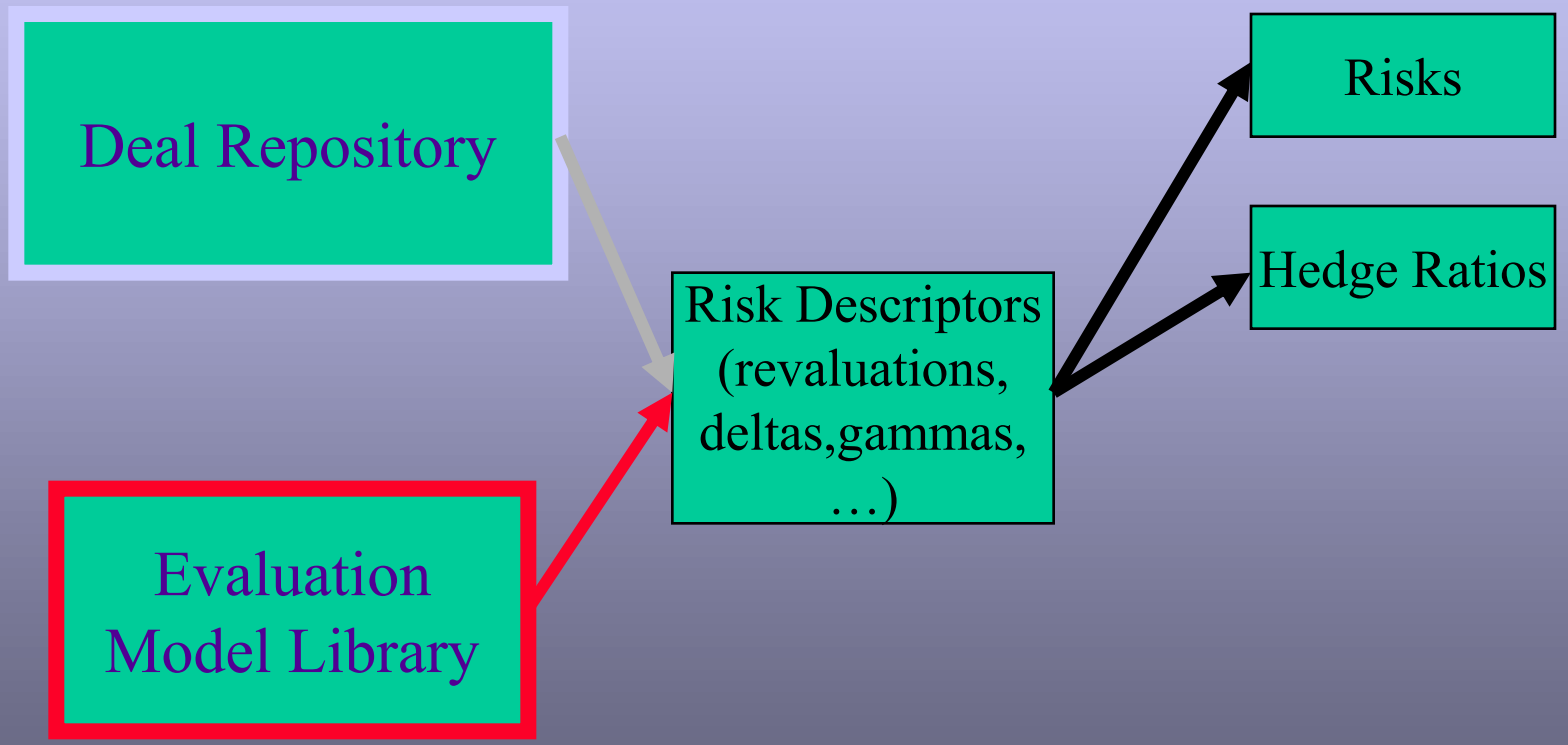


- Additive among portfolios
- Sufficient to generate risks and hedges calculations

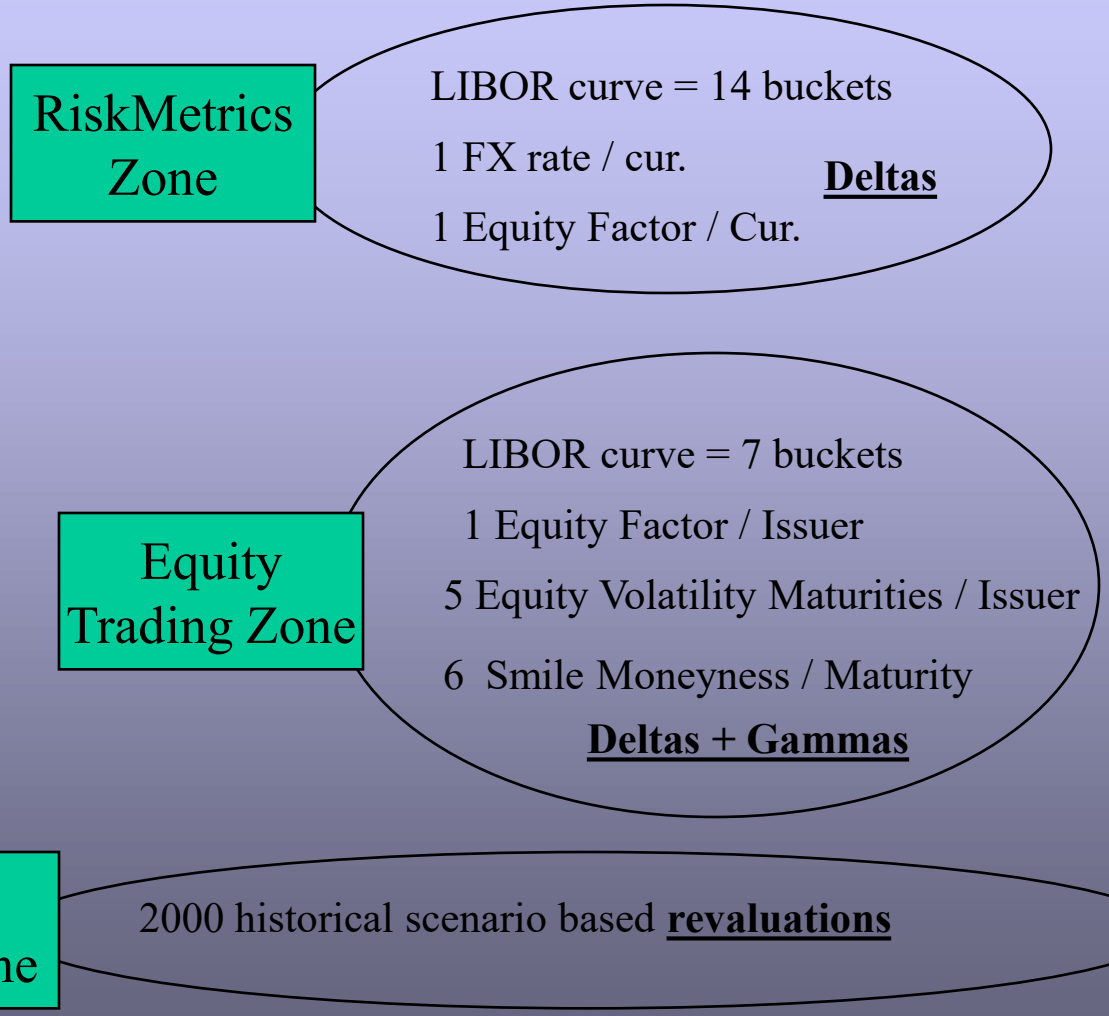
Aggregation of Risks



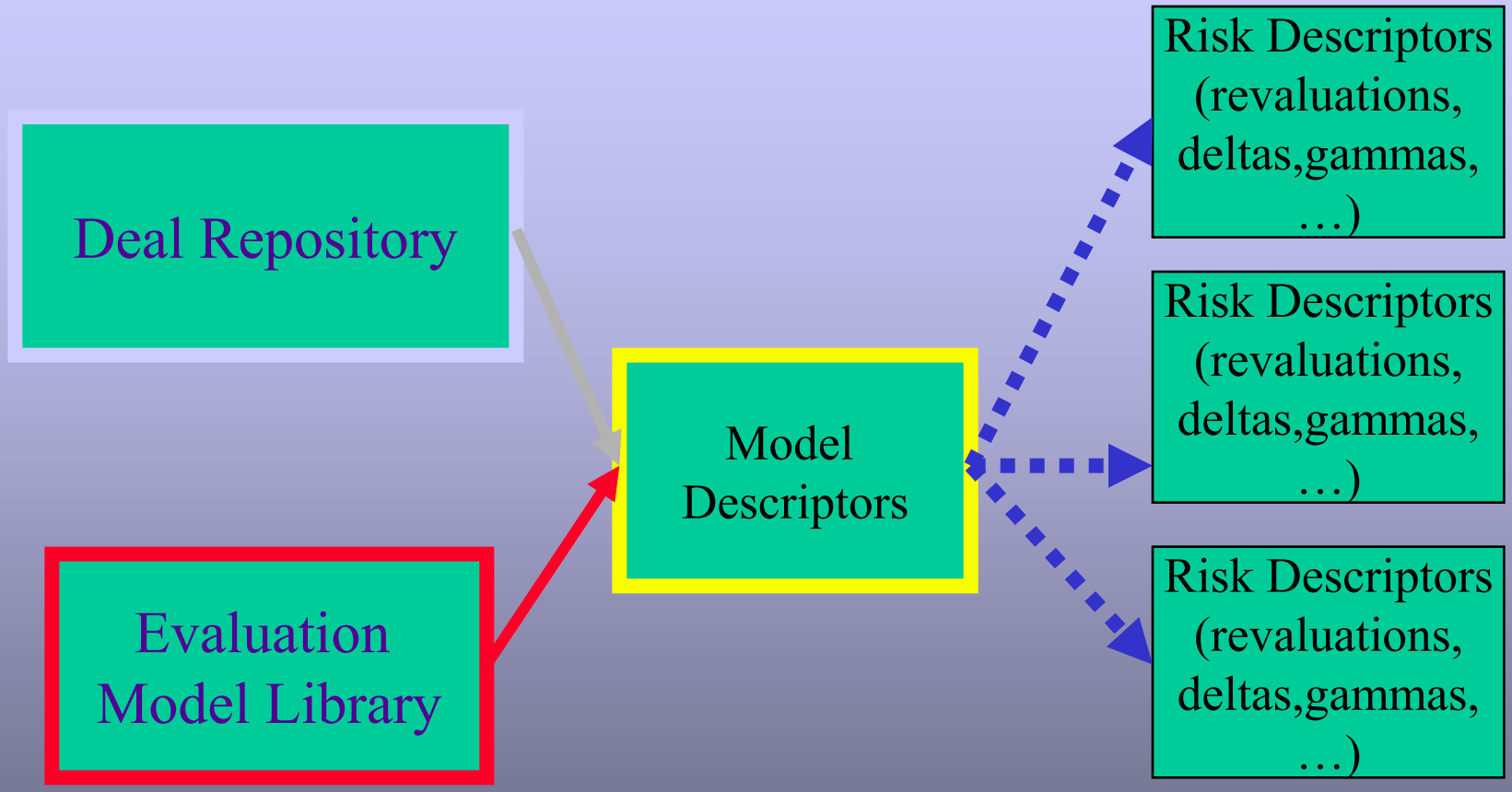
Risk Descriptors as Natural Aggregators



Diversity of the Risk Descriptors



Model Descriptors as Risk Descriptor Generators



- Aggregation property
- Independent of the discretization of curves and surfaces

Example of Risk Computation

Deal

Treasury Bill 83 days , $ 50 M 5.5 % discounted

Model Descriptor

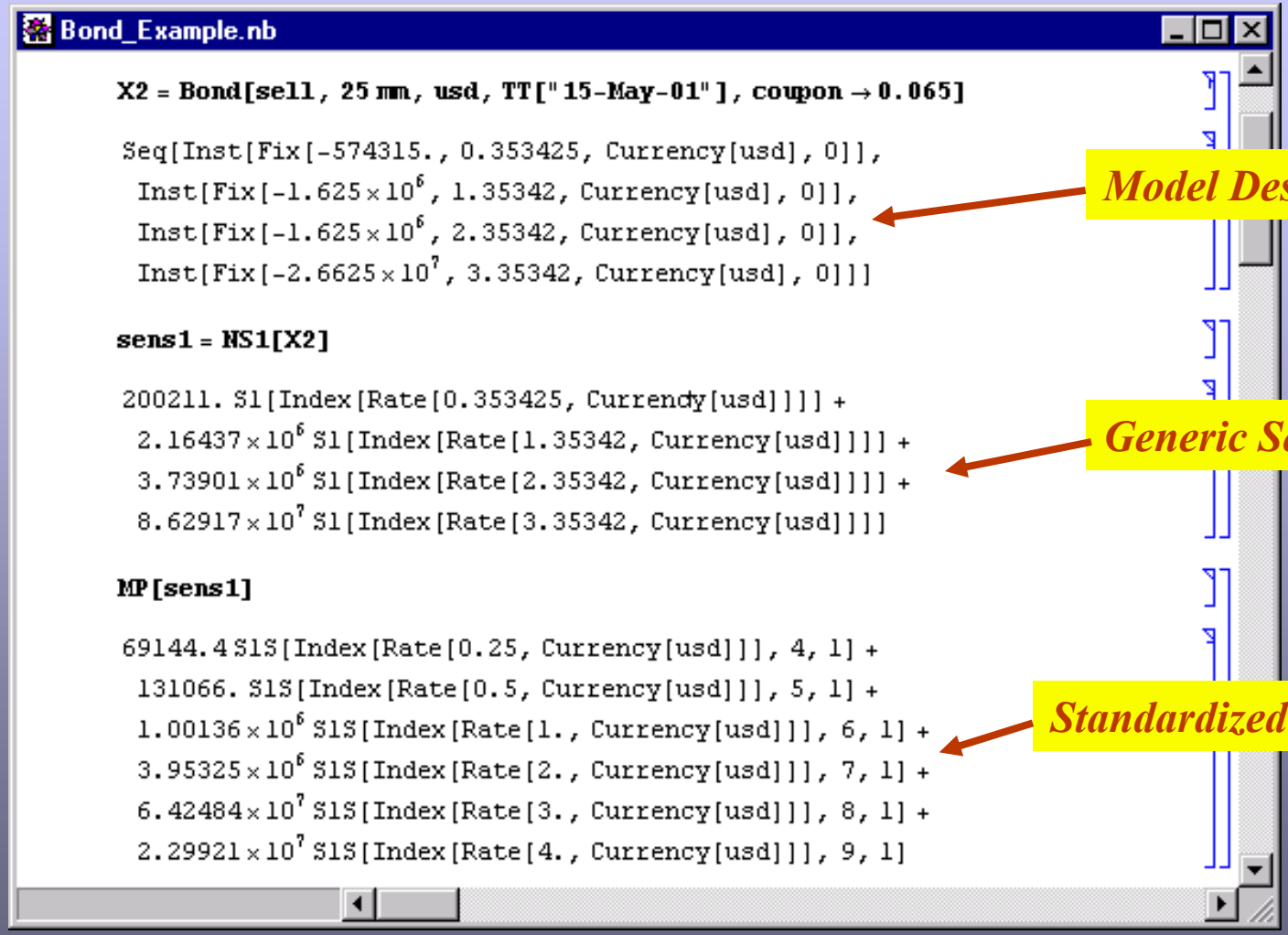
50 M * (1-83/360*(LIBOR[83 days] - spread[GVT/LIBOR,83 days])) in USD

General IR Risk Descriptor

-3,522,256 LIBOR[usd,1 m] -8,005,521 LIBOR[usd,3 m]

1 Bus. Day Risk : $ 535,876

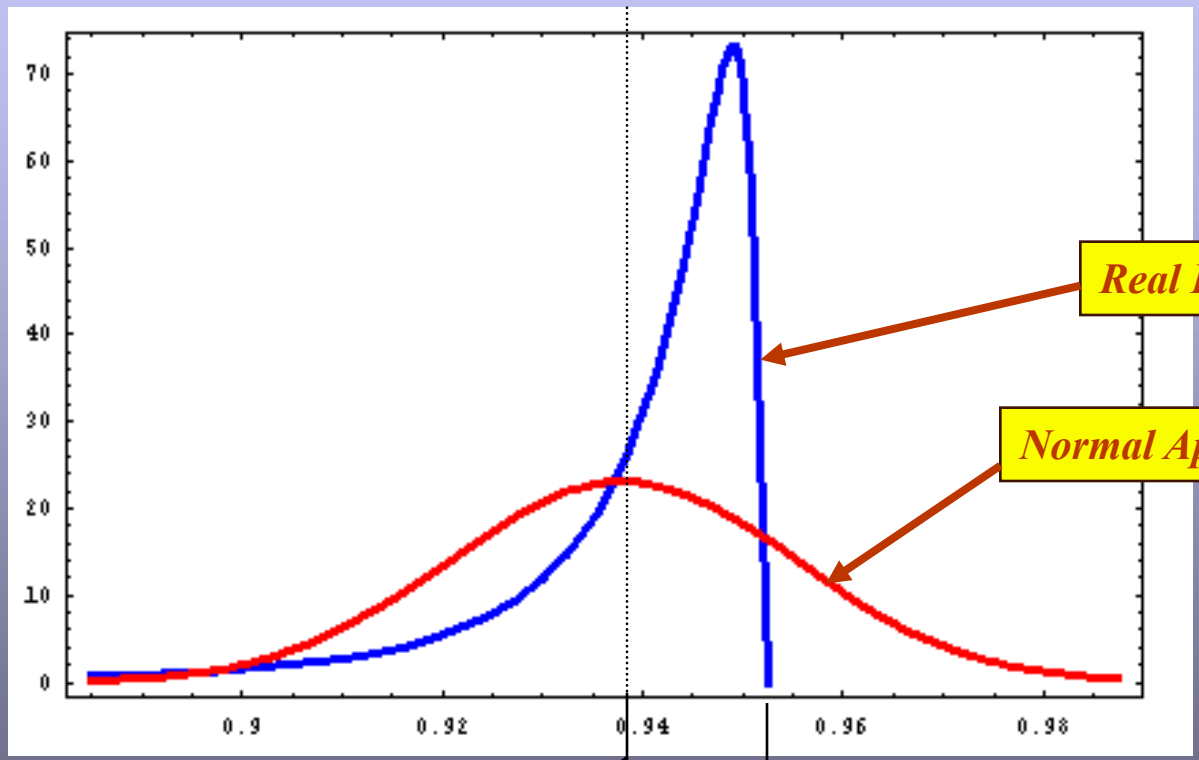
Mathematica Example



Credit Risk (MtM approach)

2 years bond, 1 year horizon $\quad B = \dfrac{1}{(1+r+s)^T}$ $\quad$ s: lognormal

Complete default : s--> infinity (approximation)



MtM and Defaulting Statistics

four years horizon
three years horizon
two years horizon
One year horizon

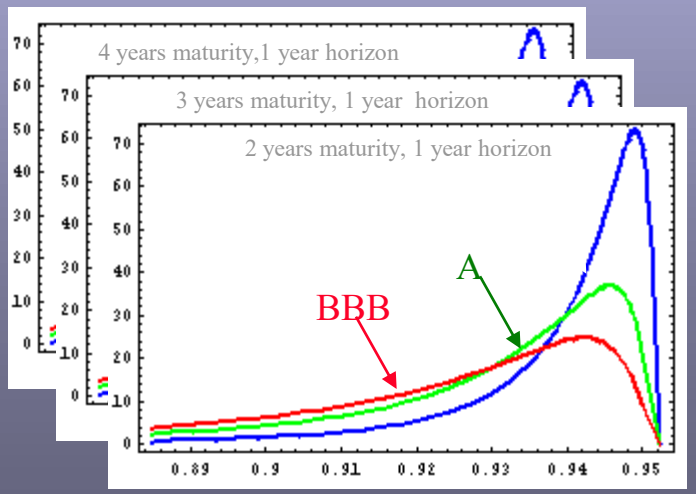
	AAA	AA	A	BBB	BB	B	CCC	default
AAA	90.81	8.33	.68	.06	.12	.00	.00	.00
AA	.70	90.65	7.79	.64	.06	.14	.02	.00
A	.09	2.27	91.05	5.52	.74	.26	.01	.06
BBB	.02	.33	5.95	86.93	5.30	1.17	.12	.18

Recovery Rates	
Senior secured	53.80%
Senior unsecured	51.13%
Senior subordinated	38.52%
Subordinated	32.74%
Junior subordinated	17.09%

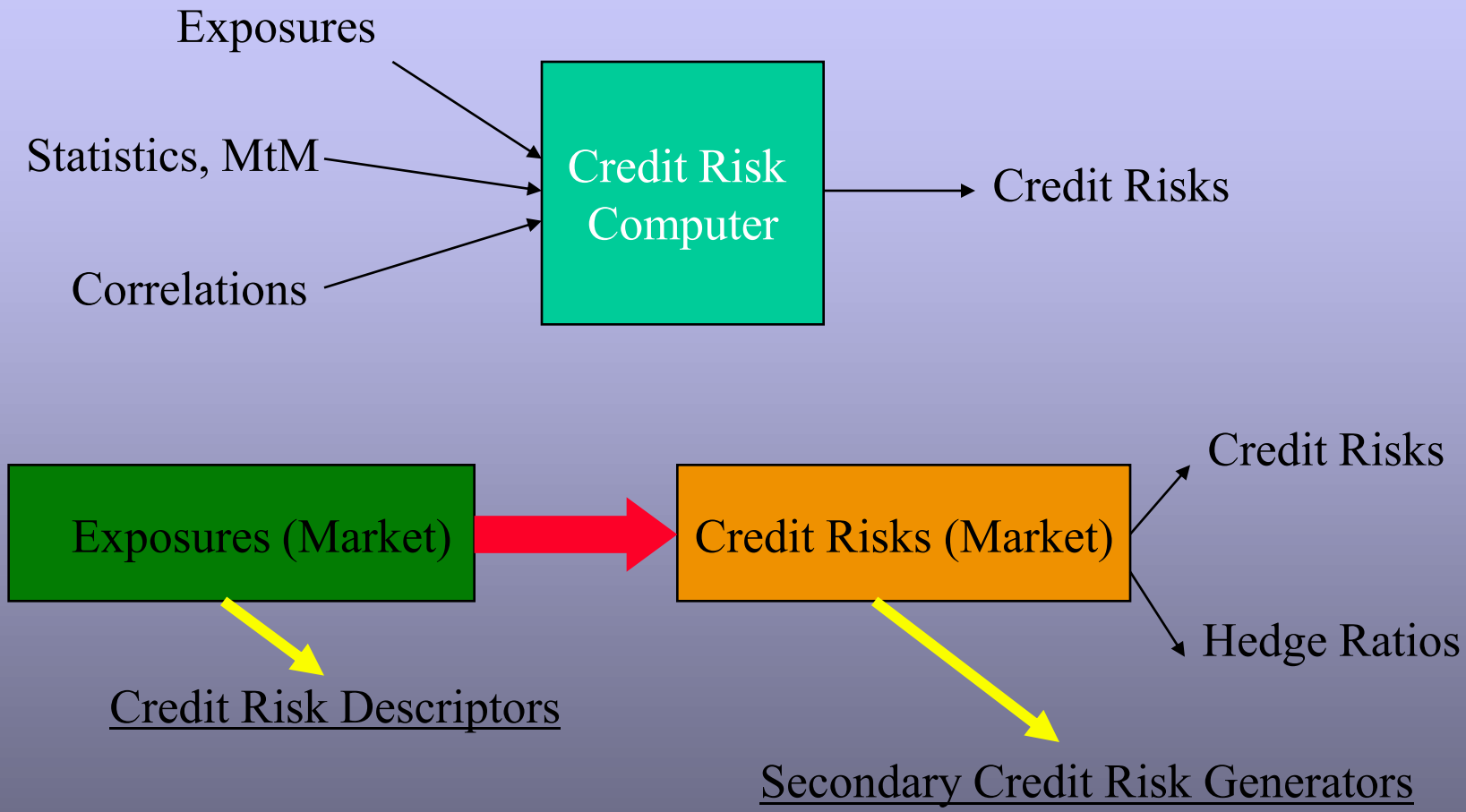
+ Good Model

Historical Volatility

Option Prices



Conditioning Credit Risk



Conclusion

- Different levels of complete risk descriptors are a power unifying firmwide risk management paradigm.
- Integration is the only way for a worldwide risk management , the risk aggregation levels should be clearly identified.
- Credit Risk And Market Risk Can be represented within a unified framework

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