global resources
local delivery

D&O Reinsurance Pricing
A Financial Market Approach

2005 Fall CAGNY Meeting
December 7, 2005

Athula Alwis and Vladimir Kremerman

Willis Re Inc.

W

Contents

- Securities Class Action Landscape

- Purpose of the Approach

- Proposed Methodology

- Data and Assumptions

- Modeling Losses

- Risk Transfer

- Side A Cover

- Conclusion

global resources
local delivery

Largest settlements to date

Rank	Corporation	Settlement Amount
1.	Enron	$7.2 billion
2.	Cendant Corporation	$3.5 billion
3.	AOL Time Warner	$2.5 billion
4.	McKesson	$960 million
5.	Adelphia	$765 million
6.	Lucent	$673 million
7.	Raytheon	$535 million
8.	Bank of America	$490 million
9.	Dynergy	$474 million
10.	Waste Management	$457 million

global resources
local delivery

The settlement amounts for the top 7 law firms as of 2004

Rank	Law Firm	Settlement Amount
1	Bernstein Litowitz Berger & Grossman	$3.5 billion
2	Barrack Rodos & Bacine	$2.9 billion
3	Milberg Weiss Bershad & Schulman	$900 million
4	Chitwood & Harley	$583 million
5	Berman DeValerio Pease ….	$579 million
6	Grant & Eisenhofer	$569 million
7	Stull Stull & Brody	$536 million

Source: Securities Class Action Services (SCAS)

Securities Class Action Landscape

Types of Allegations in 2004

- Misrepresentations in financial documents: 79%
- False forward looking statements: 67%
- GAAP violations: 48%
- Insider Trading   39%

Note: 87% of the claims were Section 10b-5 claims

Source: Cornerstone Research – 2004: A Year in Review

Securities Class Action Landscape

Types of Law Suits

Type of Law Suit	2001	2002	2003	2004
Mutual Fund	0	0	19	21
Analyst	5	41	18	1
IPO Allocation	312	1	0	0
Classic	175	229	184	214
Sub-total	492	271	221	236

Source: Stanford Law School: Securities Class Action Clearing House in cooperation with Cornerstone Research

- Objective reinsurance pricing methodology based on financial market theory to quantify the risk of writing a public D&O reinsurance portfolio

- Risk transfer mechanisms using reinsurance and capital markets

- Return on capital indication based on the proposed pricing methodology

global resources
local delivery

$$f(\mathrm{L}) = f(\mathrm{M, D, L, C}),\ where$$

- $f(\mathrm{L})$ – Distribution of D&O losses

- M - Market Capitalization of the company

- D – Frequency of law suits as a function of default rates, credit spreads, volatility of the stock price and/or credit spreads, regulatory investigations, prior M&A or IPO activity, number of shareholders owning 5.0% or more of the outstanding stock

- L – Loss as a function of the market cap

- C – Correlation within and between sectors

Market Capitalization

- Independent exposure base that is publicly available and easily verifiable

- Objective exposure base not dependant on company management

- Reasonable and consistent relationship between market cap and corresponding losses

Frequency of Law Suits

The base number of law suits is generated using publicly available credit ratings from Moody's and S&P to represent industry defaults

The fundamental assumption is that each default corresponds to a potential D&O law suit

The base number will be increased using various parameters to reflect additional law suits that are likely to be filed beyond the number of defaults

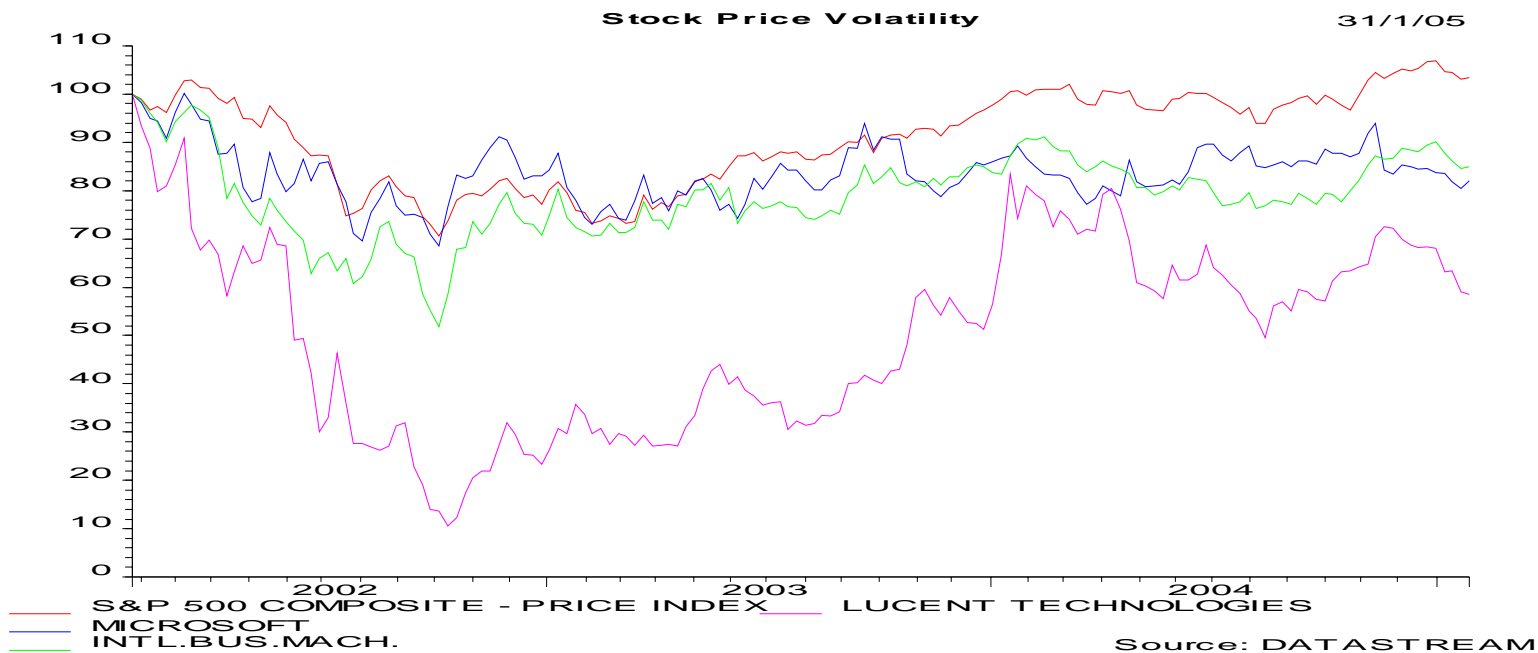## Adjustments to the Frequency Parameter

- Credit ratings are adjusted to reflect outlook of each security, and minimum of adjusted ratings is selected

- Credit spreads indicate a credit rating for each company. Each company's credit rating is further down graded if the spread implied credit rating is lower than the rating adjusted for the outlook

- The volatility of the financial performance is measured using two parameters:
  – volatility of the credit spreads
  – volatility of the stock price

- Based on the volatility index, a downgrade of adjusted credit rating is recommended

Adjustments to the Frequency Parameter

*Example: Comparison of stock price movement of IBM, LU, MSFT against S&P 500
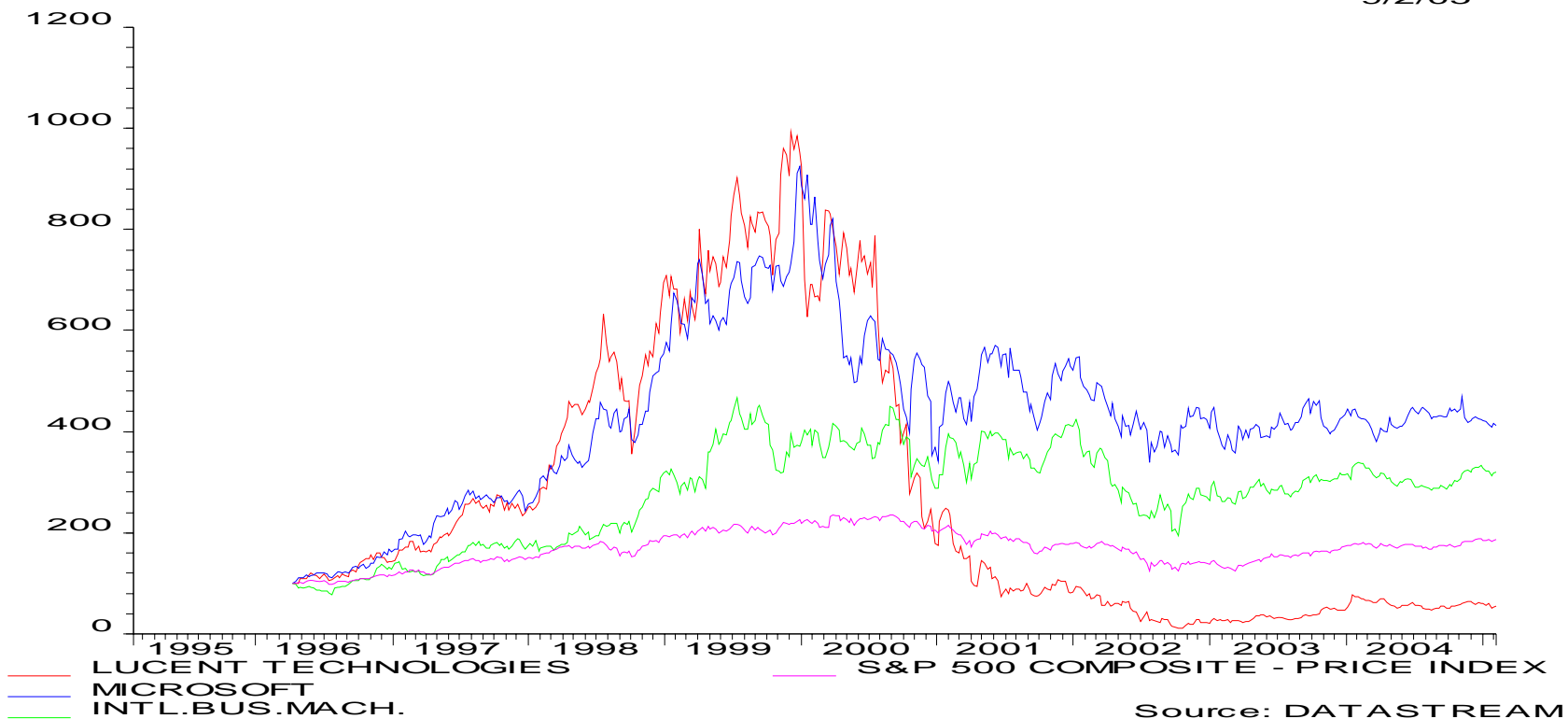(all rebased to 100)*

Stock Price Movement

Adjustments to the Frequency Parameter

Example: Comparison of the stock price movement of IBM, LU, MSFT against S&P 500 (all rebased to 100)

10 Year Stock Price Volatility

9/2/05

LUCENT TECHNOLOGIES — S&P 500 COMPOSITE - PRICE INDEX
MICROSOFT
INTL.BUS.MACH.

Source: DATASTREAM

13

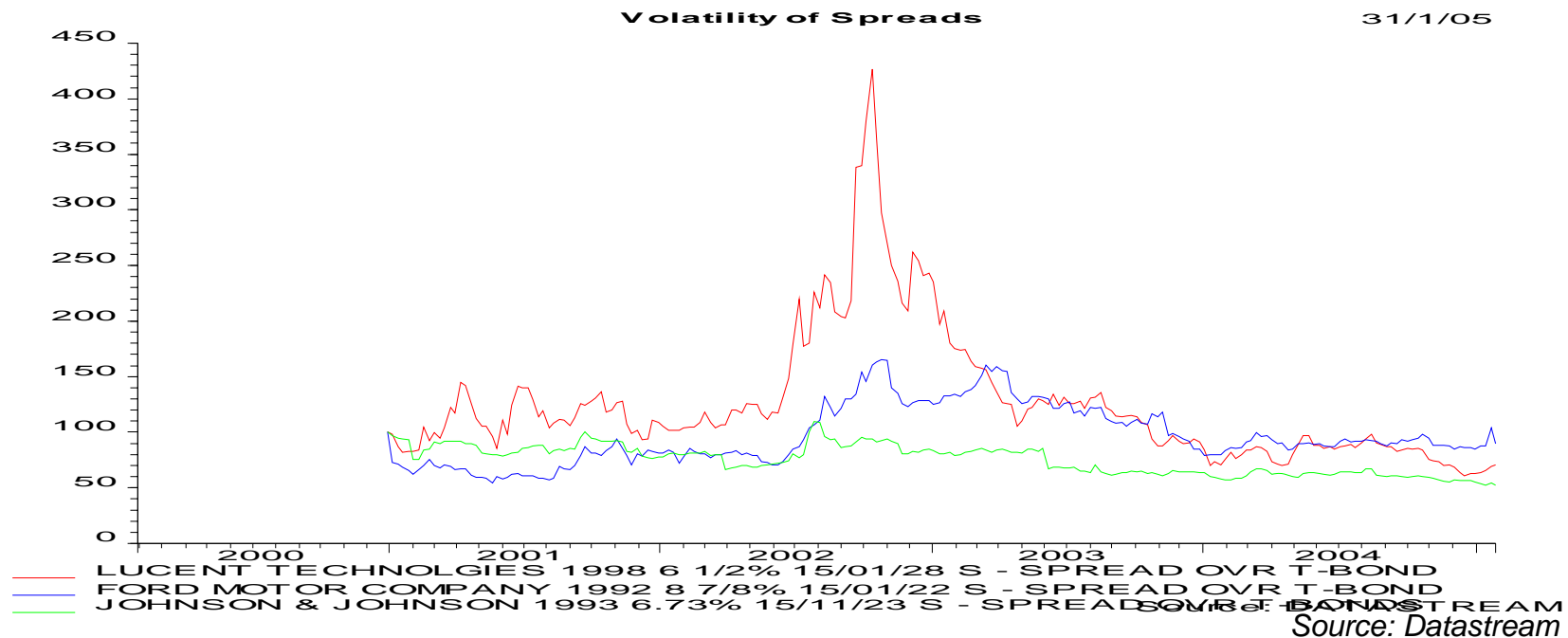## Adjustments to the Frequency Parameter

Example: Comparison of spreads for Ford, LU, J&J (all rebased to 100)

Volatility of Spreads

Source: Datastream
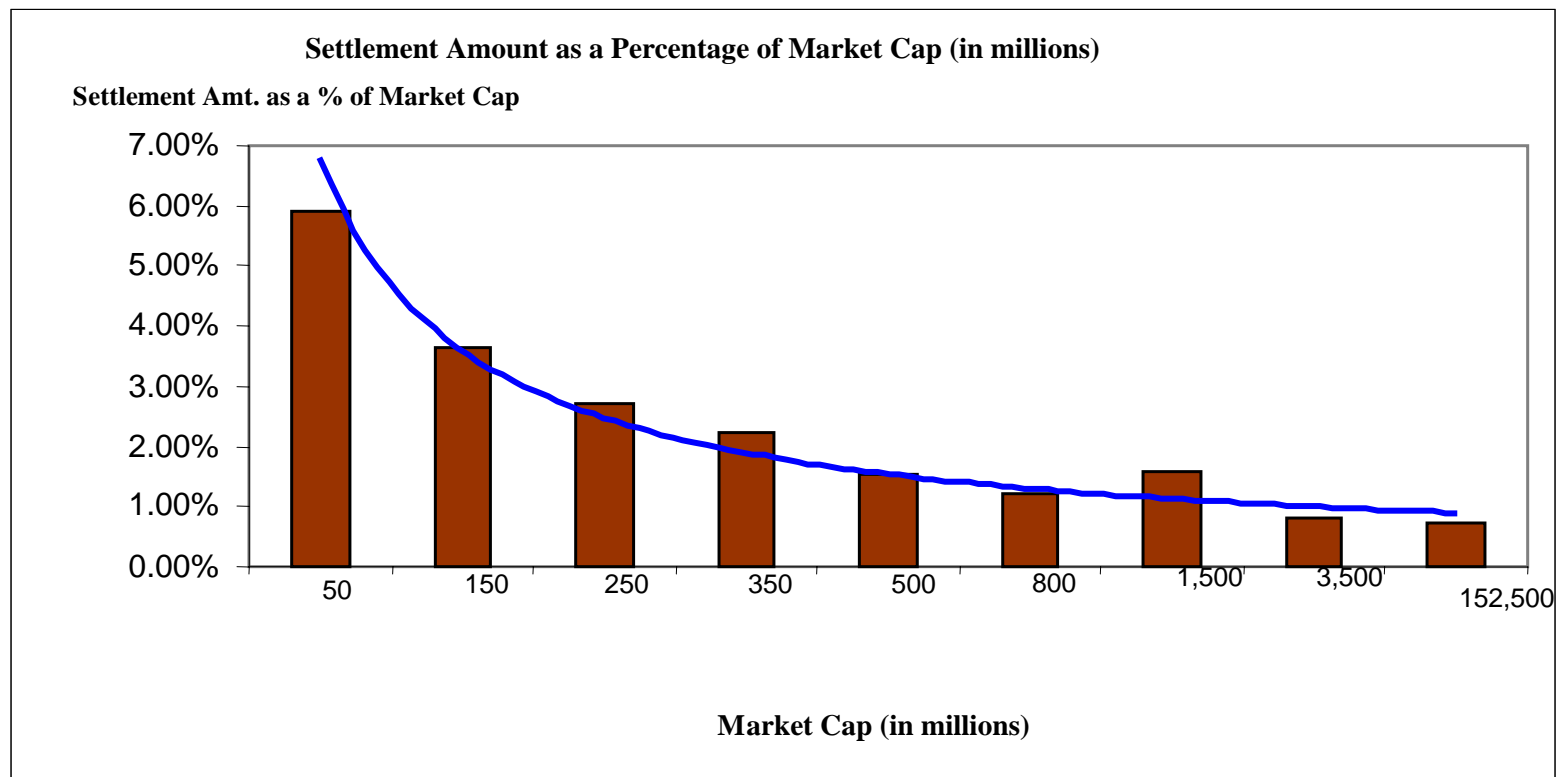
14

Adjustments to the Frequency Parameter

- If the company is under a regulatory investigation the credit rating has to be adjusted downward to reflect the increased likelihood of a law suit

- A downgrade of the credit rating is applied if there are institutional investors owning more than 5.0% of the outstanding stock

- A downgrade of the credit rating is applied if there has been any M&A activity or an Initial Public Offering during the past three years by the company

As the adjusted credit rating decreases the corresponding default rate increases (reflecting a higher probability of default, thus a higher number of law suits)

Loss as a function of Market Cap

Willis Analytics

Settlement Amount as a Percentage of Market Cap (in millions)

Settlement Amt. as a % of Market Cap

7.00%	
6.00%	
5.00%	
4.00%	
3.00%	
2.00%	
1.00%	
0.00%	

50   150   250   350   500   800   1,500   3,500   152,500

Market Cap (in millions)

Source: Stanford Law School data

Correlation within and between sectors

- Projection of material correlation within industry sectors and a nominal amount of correlation between sectors

- Recognition of the potential for correlated loss events when generating aggregate D&O losses

- Development of a correlation matrix available for simulation

Correlation within and between sectors

Creation of a Correlated Multi-Variate distribution

- A Normal Copula Function

- Formula based on Merton (Pugachevsky 2002)

$$\rho_{ij} = \frac{N^{(2)}(N^{-1}(u_i), N^{-1}(u_j), \rho_{ij}^M) - u_i u_j}{\sqrt{u_i(1-u_i)u_j(1-u_j)}}$$

Correlation within and between sectors

Rebonato and Jackel Adjustment

- To make the correlation matrix positive definite

Improvements

- Generalized form of Archemedian Copula to attain better tail dependency and to incorporate the time of default

Modeling Losses

- Apply the proposed methodology to a portfolio of risks simultaneously in a simulation environment

- Create a correlated multi-variate default distribution to model a distribution of D&O losses

Willis Analytics
Directors & Officers Reinsurance Model

Average Life	1
Default Stress Factor	1
Number of Accounts	200
Number of Sectors	6
Number of Simulations	10,000
layers	4

Index	Account Name	Market Cap	Sector	Original Rating	Adjusted Rating	Loss as % of Mkt Cap	Std. Dev.	Stressed Default Rate	IG Flag
1	Company 1	150,000,000,000	6	Aa3	A2	0.73%	2.23%	0.03%	1
2	Company 2	140,000,000,000	6	Aa3	A1	0.73%	2.23%	0.01%	1
3	Company 3	120,000,000,000	6	Baa2	Ba2	0.73%	2.23%	1.50%	0
4	Company 4	110,000,000,000	6	Ba1	Ba2	0.73%	2.23%	1.50%	0
5	Company 5	110,000,000,000	6	A2	Baa1	0.73%	2.23%	0.20%	1
6	Company 6	110,000,000,000	6	Aa1	Aa3	0.73%	2.23%	0.00%	1
7	Company 7	110,000,000,000	6	Aa3	A3	0.73%	2.23%	0.08%	1
8	Company 8	100,000,000,000	6	Aa3	A2	0.73%	2.23%	0.03%	1
9	Company 9	100,000,000,000	6	Aa3	A2	0.73%	2.23%	0.03%	1
10	Company 10	100,000,000,000	6	A3	Baa1	0.73%	2.23%	0.20%	1
11	Company 11	90,000,000,000	6	Aa3	A1	0.73%	2.23%	0.01%	1
12	Company 12	90,000,000,000	6	Aa2	A1	0.73%	2.23%	0.01%	1
13	Company 13	80,000,000,000	6	Ba1	Ba3	0.73%	2.23%	2.38%	0
14	Company 14	80,000,000,000	6	Aa3	A1	0.73%	2.23%	0.01%	1
15	Company 15	80,000,000,000	6	A1	A2	0.73%	2.23%	0.03%	1
16	Company 16	80,000,000,000	6	Ba1	B1	0.73%	2.23%	3.33%	0
17	Company 17	80,000,000,000	6	A1	A1	0.73%	2.23%	0.01%	1
18	Company 18	70,000,000,000	6	Aaa	Aa2	0.73%	2.23%	0.00%	1
19	Company 19	70,000,000,000	6	A1	A2	0.73%	2.23%	0.03%	1
20	Company 20	70,000,000,000	6	Aa3	A3	0.73%	2.23%	0.08%	1
21	Company 21	70,000,000,000	6	A3	Baa1	0.73%	2.23%	0.20%	1
22	Company 22	70,000,000,000	6	A3	Baa3	0.73%	2.23%	0.50%	1
23	Company 23	60,000,000,000	6	A1	A2	0.73%	2.23%	0.03%	1
24	Company 24	60,000,000,000	6	Aa3	A3	0.73%	2.23%	0.08%	1
25	Company 25	60,000,000,000	6	A3	Baa3	0.73%	2.23%	0.50%	1

Willis Analytics
Directors & Officers Reinsurance Model

Reinsurance Terms	Gross	XOL 1	XOL 2	XOL 3
Per Risk Limit	999,999,999,999	10,000,000	10,000,000	5,000,000
Per Risk Attachment	-	50,000,000	60,000,000	70,000,000
Aggregate Limit	999,999,999,999,999	5,000,000,000	5,000,000,000	5,000,000,000
Aggregate Deductible	-	-	-	-

Percentiles of Ceded Losses	Losses				Counts			
	Gross	XOL 1	XOL 2	XOL 3	Gross	XOL 1	XOL 2	XOL 3
Mean	267,217,216	7,375,730	6,777,288	3,324,719	4.32	0.79	0.70	0.67
Std Dev	728,973,973	13,021,415	12,190,323	6,051,508	6.56	1.39	1.28	1.21
C.V.	273%	177%	180%	182%	152%	176%	182%	181%
Median	25,649,508	0	0	0	2	0	0	0
Min	0	0	0	0	0	0	0	0
Max	5,129,298,104	74,806,776	70,000,000	35,000,000	54	8	7	7
10.0%	-	-	-	-	-	-	-	-
20.0%	254	-	-	-	1	-	-	-
30.0%	243,748	-	-	-	1	-	-	-
40.0%	2,711,322	-	-	-	2	-	-	-
50.0%	25,649,508	-	-	-	2	-	-	-
60.0%	59,526,921	4,137,753	-	-	3	1	-	-
70.0%	132,303,792	10,000,000	10,000,000	5,000,000	4	1	1	1
80.0%	286,465,545	10,000,000	10,000,000	5,000,000	6	1	1	1
90.0%	561,757,063	20,000,000	20,000,000	10,000,000	9	2	2	2
95.0%	1,232,527,645	30,000,000	30,000,000	15,000,000	14	3	3	3
96.0%	1,259,346,346	30,001,864	30,000,000	15,000,000	15	3	3	3
97.0%	1,369,173,327	30,355,262	30,300,000	15,150,000	18	4	3	3
98.0%	1,564,548,151	40,928,633	40,404,292	20,200,000	18	5	4	4
99.0%	4,500,631,555	70,048,068	60,312,448	30,050,000	20	7	7	6
99.5%	4,814,964,829	72,427,422	65,156,224	32,525,000	37	8	7	7

Modeling Losses - Next Steps

- Enhance the model to incorporate individual limits and retentions for each and every company in the portfolio

- Update the severity curve based on most recent data

- Test the model against a national portfolio

- Incorporate a Portfolio Optimization Tool

- Develop Marginal Capital Requirements based on portfolio changes

- Use non linear regression (logit or probit) to predict frequency and correlation

- Reinsurance

  – Quota Share

  – XOL

  – Aggregate Covers

- Capital Markets

  – CDO type structures

  – Call Options

global resources
local delivery

Key Factors

– **Insolvency (Modeling)**

– **Derivative Litigation (Judgment)**

Additional factors to consider (mainly for Side A Excess)

– Bankruptcy of the underlying carrier

– Rescission of the underlying policy

– Unavailability the underlying policy due to a restatement exclusion

– Breach of a non-severable warranty

– The underlying policy becoming an asset of the estate due to a declaration by the bankruptcy court

global resources
local delivery

This financial market approach has the ability to

- Use an objective model to quantify the risk-return profile of a D&O portfolio as needed

- Provide risk transfer mechanisms through reinsurance and capital markets

- Allocate capital in an objective and reasonable manner

- Present a measure of risk across lines of business and corporate entities