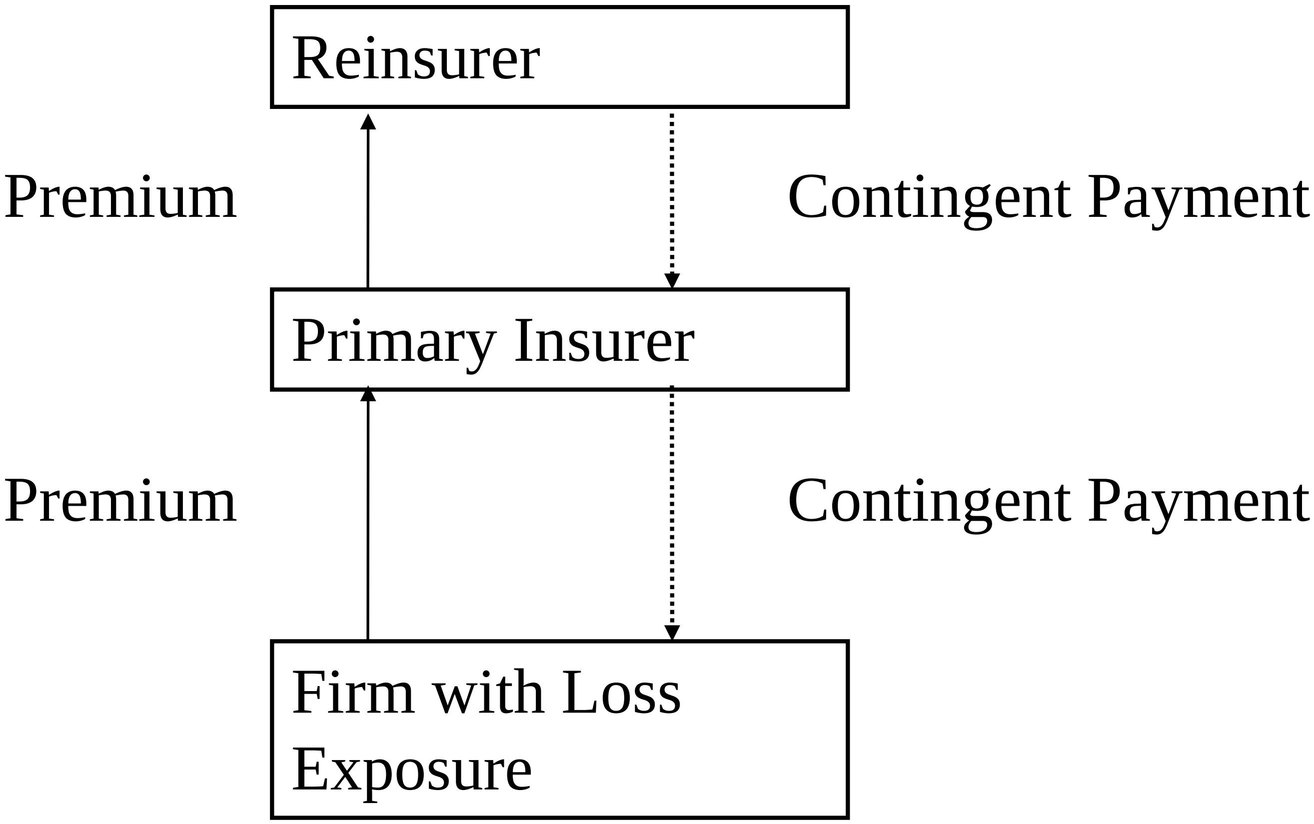
A Reinsurance Primer

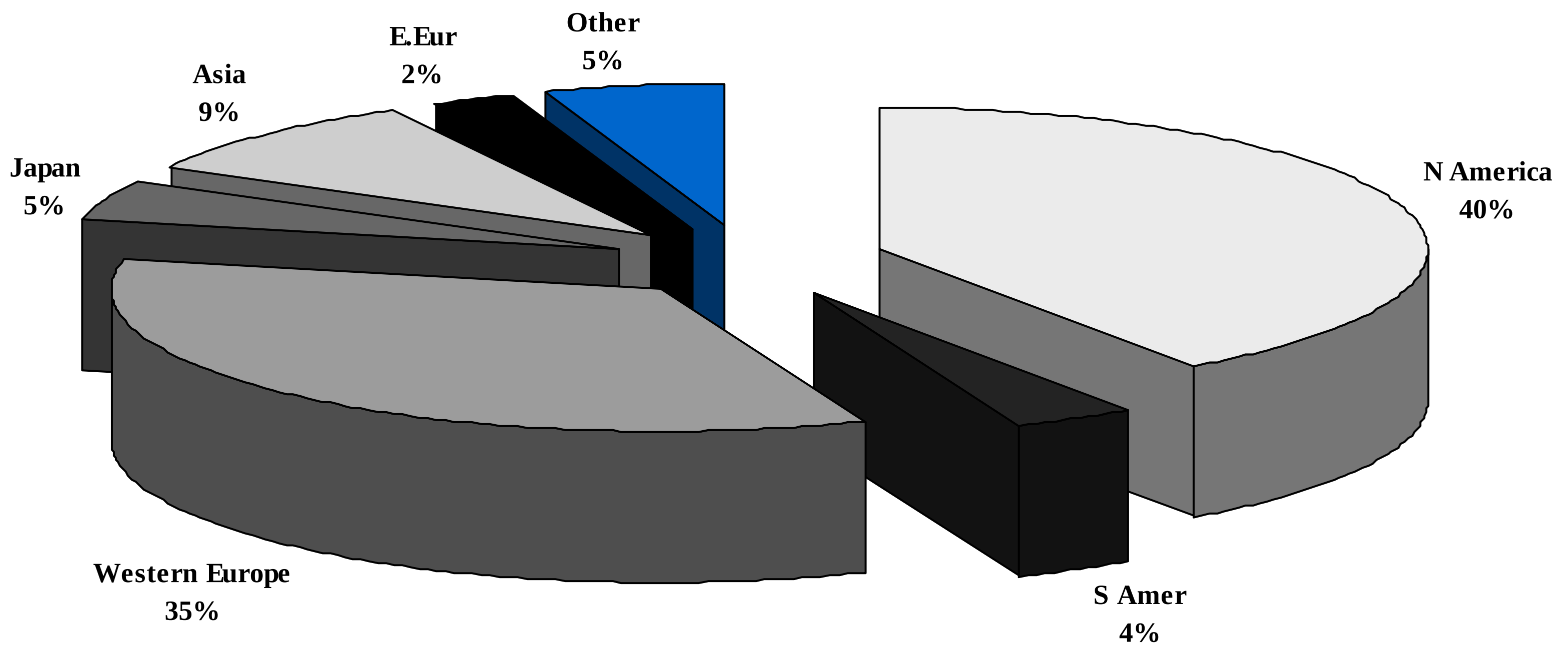
Based upon "Reinsurance and Financial Strategies" (Fall 2004),
by J. David Cummins*

*This lecture note represents an abridged and (lightly) edited version of a Fall 2004 lecture note by J. David Cummins entitled "Reinsurance and Financial Strategies" (Copyright 2004 by J. David Cummins), which was used with his permission.

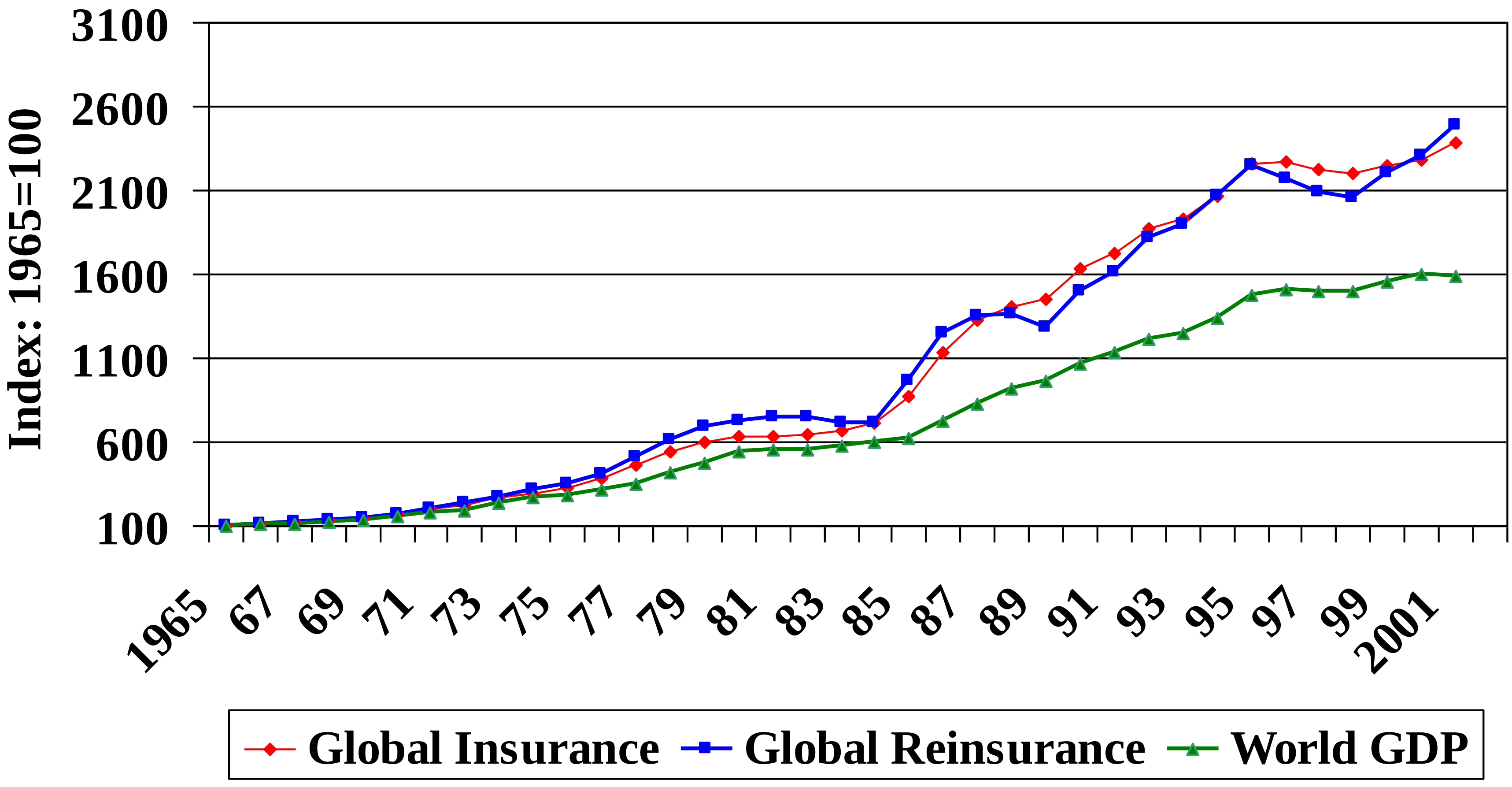
Insurance and Reinsurance



Global Demand for Reinsurance

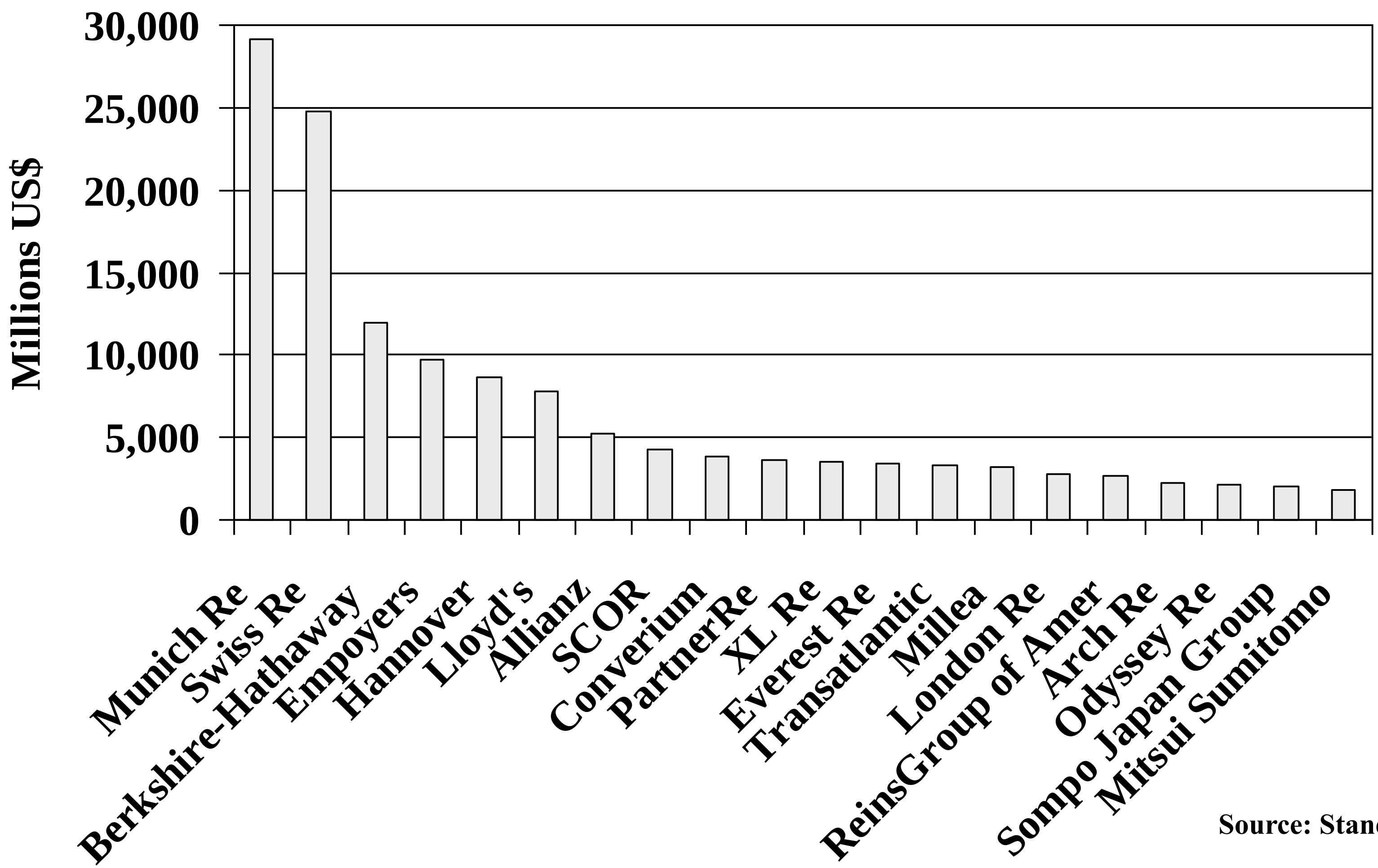


Growth of Insurance and Reinsurance Markets



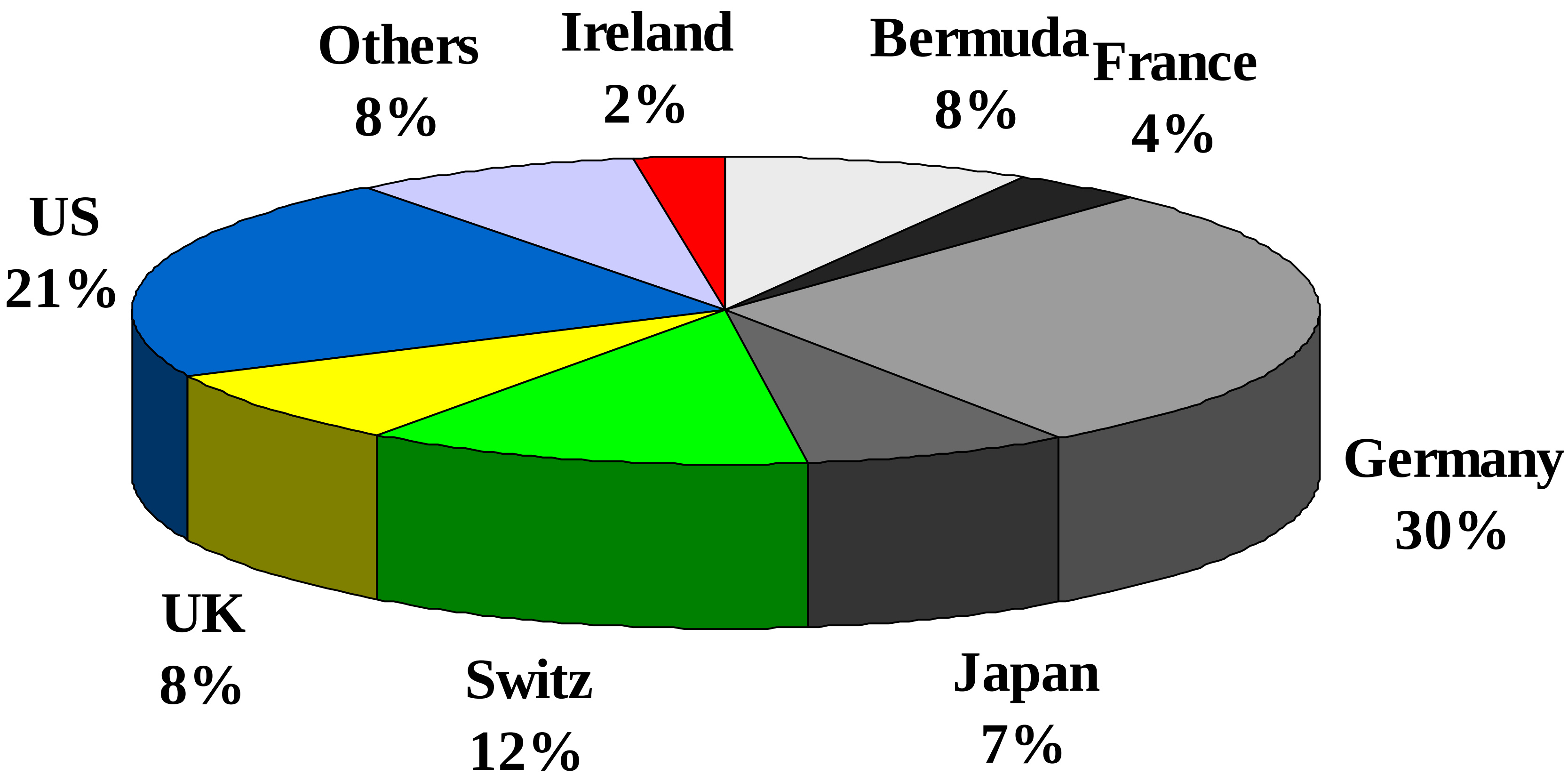
Source: Swiss Re.

The World's Top 20 Reinsurance Groups: 2003 Net Premiums Written



Source: Standard & Poor's.

Global Reinsurance Supply: Premiums By Country 2003



Source: Standard & Poor's.

Reinsurance Terminology

- Ceding company -- insurer that buys reinsurance
- Reinsurance company -- firm that supplies reinsurance
- Retrocessionnaire -- firm supplying reinsurance to a reinsurer

Reinsurance Terminology

- Treaty vs. Facultative Reinsurance
  - Treaty reinsurance: Applies to all policies described in the treaty.
  - Facultative Reinsurance: reinsurance that is commonly used for large or unusual risks that do not fit within standard reinsurance treaties due to their exclusions.

Reinsurance Terminology

- Proportional vs. non-proportional reinsurance
  - Proportional reinsurance: premiums and claims are split in agreed-upon proportions between ceding company and reinsurer.
  - Non-proportional: Loss not covered unless it exceeds a threshold.

Proportional Reinsurance: Quota Share

- All premiums and losses covered by the treaty are split between insurer and reinsurer in the same proportion
- Example: α = proportion retained by ceding company, $0 \leq \alpha \leq 1$
  - e.g., $\alpha = 0.6$
- Applies equally to all policies covered by the treaty regardless of size of policy limit

Proportional Reinsurance: Surplus Share

- Premiums and losses are split proportionally but the proportion differs by policy, depending on the policy limit
- Surplus share example
  - Suppose the cedent's policy has an upper limit of 800k and its line limit is 100k, and it arranges two surplus share reinsurance treaties: 1) a 3 line "first surplus" treaty, and 2) a 2 line "second surplus" treaty.

Proportional Reinsurance: Surplus Share

- Cedent retains 1st line:
  α = Line limit/Policy limit = 100/800 = 12.5%
- 1st surplus reinsurer accepts proportion
  α_1 = (3 lines)/Policy limit
  = 300/800 = 37.5%
- 2nd surplus reinsurer accepts proportion
  α_2 = (2 lines)/Policy limit = 200/800 = 25%
- Cedent retains top layer not covered by reinsurance = 200/800 = 25%
- Cedent's total retention = 1st line + top layer = 37.5%

Proportional Reinsurance: Surplus Share

- Now suppose a loss of 200k is realized. Here are the payouts:
  - 1^{st} surplus reinsurer pays .375*200 = 75
  - 2^{nd} surplus reinsurer pays .25*200 = 50
  - Ceding company pays .375*200 = 75
- Under the surplus share reinsurance treaty, proportions will be the same regardless of size of loss.

Non-Proportional Reinsurance: Excess of Loss ("XOL")

- XOL contracts have an "attachment point" and a "policy limit", similar to strike prices in options contracts.
- Reinsurer does not pay if loss is less than the attachment point.
- For losses in excess of the attachment, reinsurer pays: L – attachment, with a maximum payment equal to the limit.

Non-Proportional Reinsurance: Excess of Loss ("XOL")

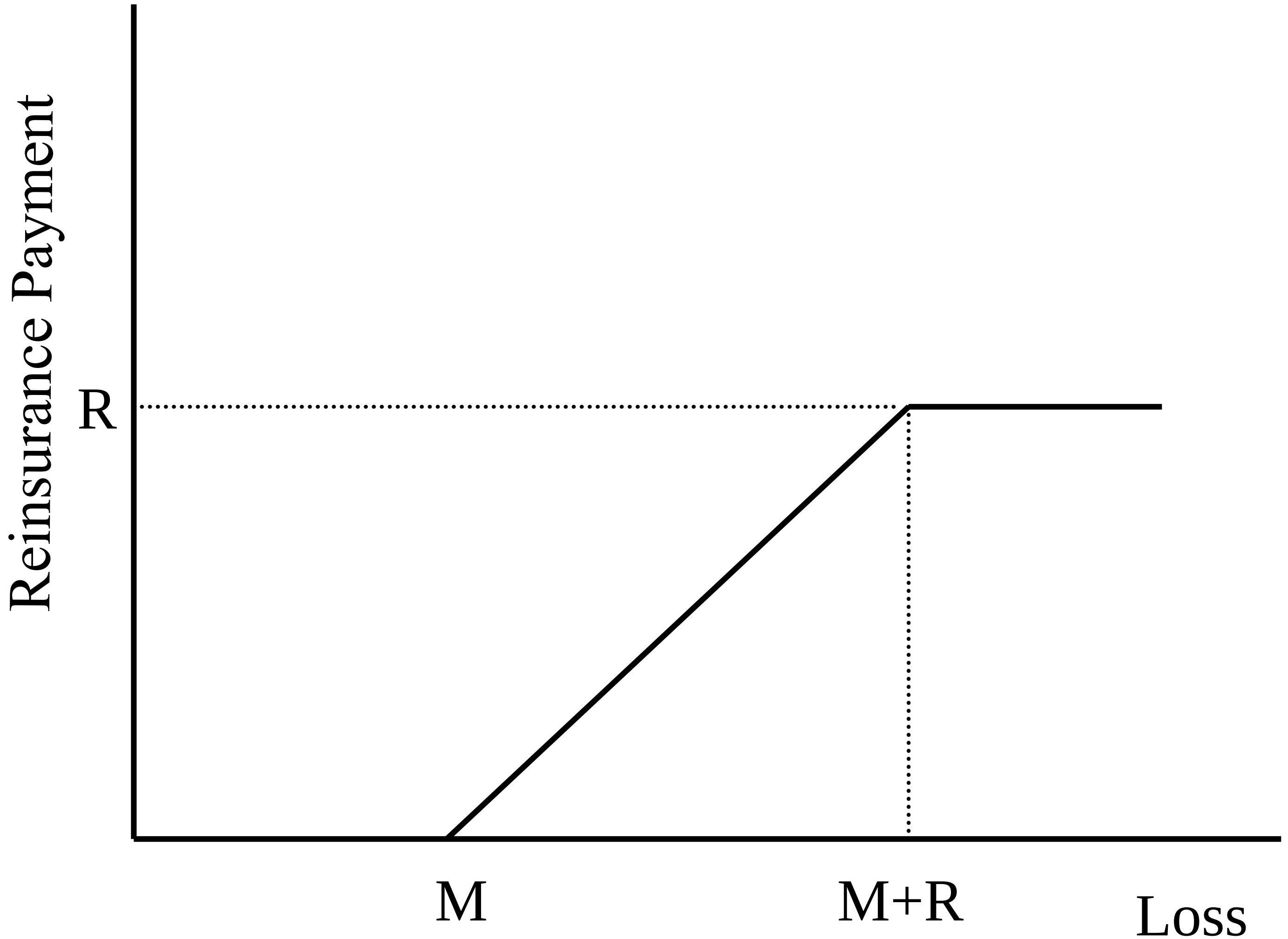
- XOL: Let M = attachment point ("lower strike)
  R = limit
  U = R+M = "upper strike"
- Cedent's net loss
  $L_c = L - [\mathrm{Max}(L-M,0) - \mathrm{Max}(L-U,0)]$
  where L_c = ceding company net loss
  L = gross loss
- Cedent is:
  - "Short" the loss
  - "Long" in a call option spread with striking prices M and U

Non-Proportional Reinsurance: Excess of Loss ("XOL")

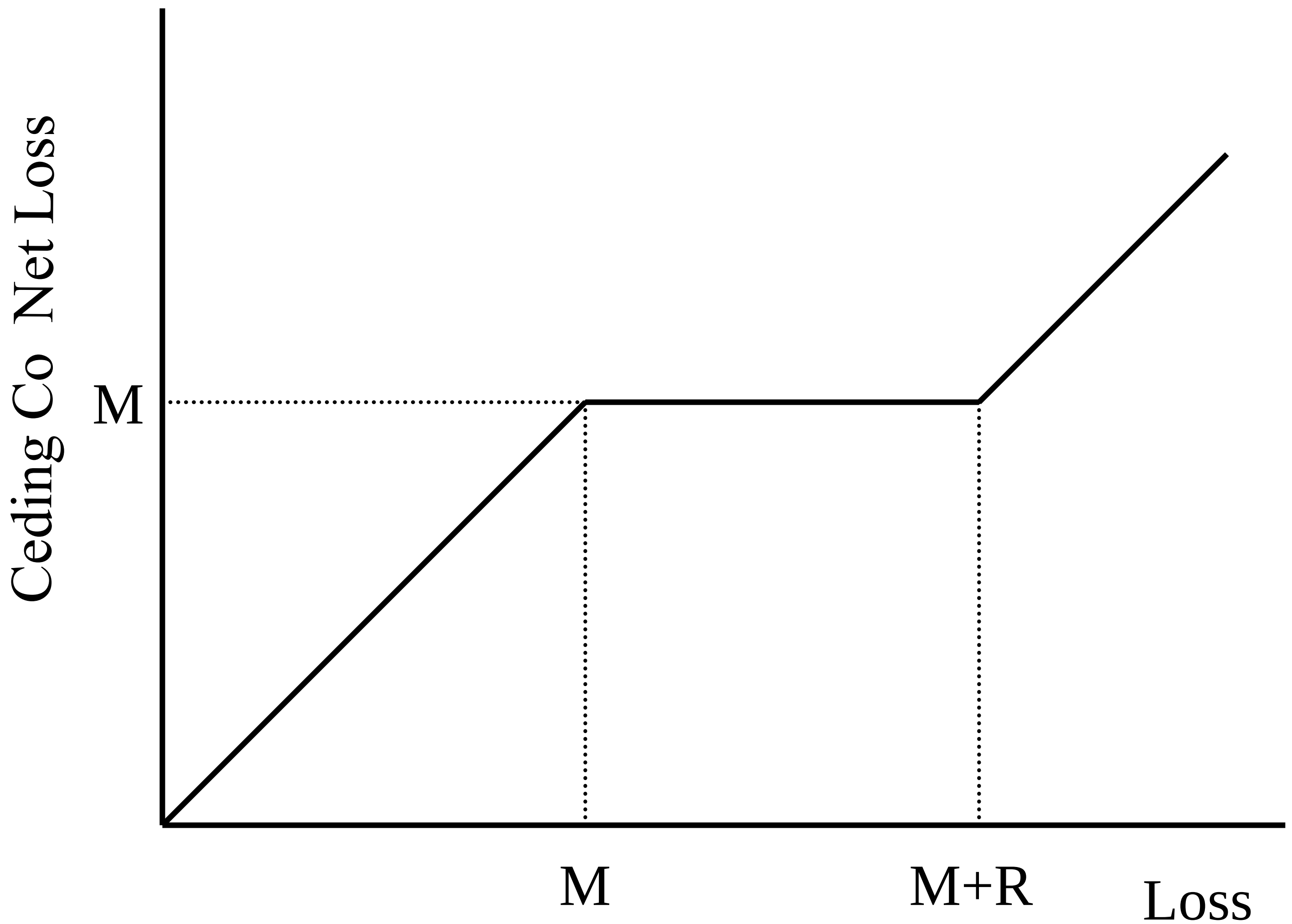
- XOL: Let M = 100, R = 200, then coverage is "200 excess of 100"
- $L_c = L - [\mathrm{Max}(L-M,0) - \mathrm{Max}(L-(M+R),0)]$
  (1) $L = 50 \Rightarrow L_c = 50$ (attachment not reached)
  (2) $L = 150 \Rightarrow L_c = 150 - 50 = 100$ (ceding company pays the attachment)

  (3) $L = 400 \Rightarrow L_c = 400 - (300 - 100) = 200$ (ceding company pays attachment plus amount in excess of upper strike)

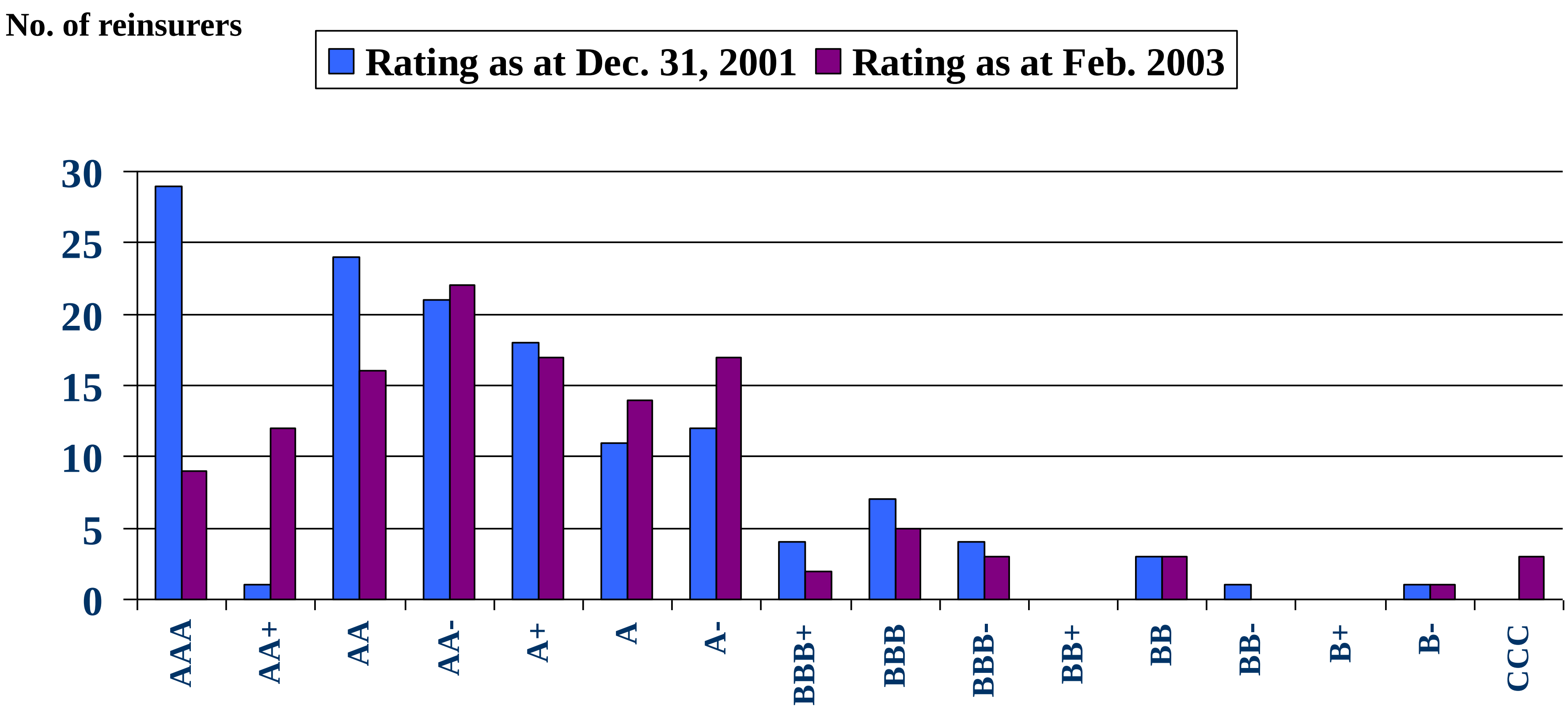
XOL Reinsurance: Reinsurer's Payment



XOL Reinsurance: Cedent's Net Loss



S&P Ratings Changes:
Top 150 Reinsurers, 2001-2003*



* Ranked by net premiums written.

S&P Reinsurance Downgrades, Jan 03 – Sep 03

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                        AAA     AA+     AA      AA-     A+      A       A-      <BBB+     Outlook
General Re              X                                                                 Stable
Swiss Re                |---------------X                                                 Stable
Chubb Re                |---------------X                                                 Stable
Employers Re            |-------------------------------X                                 Negative
Munich Re               |-------------------------------X                                 Stable
  - American Re         |---------------------------------------X                         Stable
Hannover Re                     |---------------X                                         Negative
Transatlantic Re                        X                                                 Stable
XL Re                                   X                                                 Stable
Partner Re                              |-------X                                         Stable
Hartford P/C Group                      |-------X                                         Stable
AXA Re                                  |-------X                                         Stable
Converium Re                            |-----------------------X                         Stable
Everest Re                                      X                                         Stable
SCOR                                            |-------------------------------X         Watch / Dev
Gerling Global Re                               |-------------------------------X         Withdrawn
ACE Tempest Re                                          X                                 Negative
IPC Holdings                                            X                                 Stable
W.R. Berkley                                            X                                 Negative
Lloyd's                                                 |-------X                         Stable
Trenwick Amer Re                                        |-----------------------X         Withdrawn
Renaissance Re                                          X-------|                         Stable
PXRE Reins                                                      X                         Negative
Axis Re                                                         X                         Stable
Endurance Re                                                            X                 Stable
Montpelier Re                                                           X                 Stable
PMA Capital                                                     |-------X                 Negative
CNA                                                             |-------X                 Negative
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S&P's Solvency Ratings (Secure)

- **AAA (Extremely Strong)** - This is S&P's highest insurer financial strength rating. Insurers with this rating have extremely strong financial security characteristics.
- **AA (Very Strong)** - Insurers with this rating have very strong financial security characteristics, differing only slightly from those rated higher.
- **A (Strong)** - Insurers with this rating have strong financial security characteristics but are somewhat more likely to be affected by adverse business conditions.
- **BBB (Good)** - Insurers with this rating have good financial security characteristics but are more likely to be affected by adverse business conditions.

S&P's Solvency Ratings (Vulnerable)

- **BB (Marginal)** - Insurers with this rating have marginal financial security characteristics, and adverse business conditions could lead to insufficient ability to meet financial commitments.
- **B (Weak)** - Insurers with this rating have weak financial security characteristics, and adverse business conditions will likely impair their ability to meet financial commitments.
- **CCC (Very Weak)** - Insurers with this rating have very weak financial security characteristics and are dependent on favorable conditions to meet financial commitments.
- **CC (Extremely Weak)** - Insurers with this rating have extremely weak financial security characteristics and are not likely to meet some of their financial commitments.