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making financial sense of the future

Tradable Catastrophe Risk

A new protection strategy

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Agenda

- Catalysts to Change
- Tradable Catastrophe Derivatives
- Reinsurance vs Derivatives
- Basis Risk
- Market Feedback

Catalysts to Conception

- The lengthy delays it took to place “live cat” as Hurricane Rita as it approached Galveston Island
- Hedge funds collaterising 100 cents on the dollar for reinsurance limits
- Hedge Fund comments:
 - “If I buy a bad equity I can get out of it”
 - “Easy to get money into a reinsurance company, impossible to get it out”
- The high costs and complex infrastructure needed to set up a reinsurer
- Delays between funding the gross losses and receiving recoveries

Insurance Market Issues

- Catastrophe protection requirements at an all time high
- Traditional markets were putting up the “Full” sign – 35% shortfall in capacity for US Windstorm
- The potential for 20 years of more frequent and severe hurricanes - AMO
- Increasing exposure base
 - 1500 building permits are issued a day in coastal counties in the US
 - Florida will become the 3rd most populous state by 2010
- Changes in rating agency requirements
 - Reinsurance approach may no longer be the most efficient due to an increase in capital requirements

Insured Coastal Property Values 2004

- Florida USD 1.937bn
- New York USD 1.901bn
- Texas USD 742m
- Massachusetts USD 662m
- New Jersey USD 505m
- Connecticut USD 404m

Reinsurance Market Issues

Market Capacity June 2006 for US Windstorm

- Capacity needed 2005 USD 40.0bn
- Cat Model Changes x 165.0%
- Capacity Needed 2006 USD 66.0bn
- Class of 2005 provided USD 3.0bn

Shortfall 2006

USD 23.0bn

- Solution - Cat Bonds, New Companies, ILWs ????

Catastrophe Derivatives – A Solution

- A new asset class would be created

Catastrophe-based futures and options contracts

- Access to a wider marketplace / greater capital base
- Transparency in pricing
- Reduced frictional costs
- Can sell / close out before year end to realise gains
- **First fully tradable catastrophe protection product**

Tradable Catastrophe Derivative Contracts

- Futures and options contracts
- Standardised exchange-traded derivatives and negotiable Over-the-Counter (OTC) contracts
- Exchange-traded derivatives are cleared through Clearing House, also some OTC e.g. NYMEX via Clearport Clearing TM
- Contracts settled against predefined catastrophe index
- Marked to market i.e. daily valuation
- Margins typically adjusted daily to maintain creditworthiness
- Futures / options accounting

Why Would Capital Markets Trade?

- Regarded by investment markets as having low correlation to existing asset classes
 - – can enhance potential return and reduces volatility
- Familiar investment product versus a reinsurance product
- Immediacy of trading, pricing transparency & low frictional costs
- Additional hedging tool for investors in equity vehicles exposed to natural catastrophe
- Traded on a margined basis - more efficient than fully collateralized reinsurance
- Allows assumption of exposures without investment in underlying insurer / reinsurer infrastructure

Practical Development Hurdles

NYMEX CAT Risk Contracts

- Terminology: (re)insurance vs capital markets
- Different FSA licences for broking (re)insurance vs derivatives / financial contracts
- Patent application process
- Long term agreements with NYMEX and PCS
- Educating potential buyers and sellers on how the other side operates

Key Differences

Cat Reinsurance Contracts vs Traded Derivative Contracts

Contract of Indemnity

- Lengthy negotiations
- Restrictive / changing T&Cs
- Credit risk
- Concentration of participants
- Unwillingness to pay - disputes common
- Very large limits attract higher pricing
- Reinsurance - Favourable accounting
- Well understood by reinsurance buyers / underwriters

Contract for Difference

- Virtually instantaneous trading
- Standardised, ISDA-based plus OTC flexibility
- Clearing House plus clearing member; margins adjusted daily
- Broader, more diverse pool of participants
- Less disputes due to standardisation
- Small or large limits can be implemented in 'building blocks' of trades
- Asset accounting – less favourable than RI
- Not yet well understood by reinsurance buyers / underwriters

Tradeable products compared

| | Re-Ex | Carvill Hurricane Index | Select-Cat | WindX |
|--|---|---|--|---|
| Compensation / financing | Hedges for aggregate losses and potential to trade for profit. One contract covers calendar year | Hedges for single losses. New contract required for each landfall | Indemnity-based cover but triggered by synthetic portfolio | 'Standardised' index proxy for market damage dollars. 'Customised' is parametric trigger and has some event and some aggregate characteristics |
| Basis risk / retail risk | Basis risk is comparison of portfolio to market losses (but on aggregate basis) | Basis risk index value v portfolio loss | Basis risk increased as need to compare portfolio protected to synthetic portfolio | Customised – cedant bears model risk, basis risk reduced if selected index reflects portfolio |
| Moral hazard | Low moral hazard. Indexed-based | Low moral hazard. Mathematical index-based | Moral hazard. Synthetic portfolio | Low moral hazard. Mathematical index-based |
| Counterparty risk | Clearing house provides AA+ counterparty protection | Clearing house provides AA+ counterparty protection | Low. Contracts are collateralised | No information on OTC derivatives. No clearing house |
| Liquidity for risk transfer | Liquidity yet to be determined but potential to be first fully liquid, tradeable instrument | Liquidity yet to be determined but potential to be first fully liquid tradeable instrument but no OTC flexibility | Illiquid | Derivatives OTC only, may restrict liquidity. Cat bonds/illiquid |
| Regulatory / accounting / tax (RAT) rules for cedant | Asset so no favourable RAT treatment | Asset so no favourable RAT treatment | Favourable if indemnity based, unfavourable if not | Asset so no favourable RAT treatment |
| Capacity providers | Reinsurers/insurers/hedge funds /investment banks futures and options traders | Reinsurers/insurers/hedge funds/ investment banks futures and options traders | Reinsurance/hedge fund | Unknown |
| Buyers of protection | Insurers/reinsurers/cat bond writers/speculators/energy traders | Principally energy markets plus insurance/reinsurance | Insurers/reinsurers | Corporations/insurers/reinsurers as a substitute for cat (re)insurance |
| Intermediation | Via clearing members/inter-dealer brokers etc | Via clearing members/inter-dealer brokers etc | Via GC only. Fees | Unknown |
| Standardisation | Standardised plus OTC flexibility | Standardised but no OTC | Unknown | OTC |
| Complexity of underwriting | Low based upon market risk | Low based upon market risk | Complex analysis needed on underlying synthetic portfolio then how correlates to portfolio protected | Complex analysis by cedant to identify bespoke index to match portfolio. Sellers need to understand behaviour/correlations between weather stations the index is based on |
| Transparency | Yes – exchange traded | Yes – exchange traded | No – not exchange traded | No – not exchange traded |
| Method of trading | Screen based and voice broked | Screen based | N/A | N/A |
| Further information | www.re-ex.com www.NYMEX.com | www.carvill.com www.cme.com | www.guycarp.com | www.windxnetwork.com |

Basis Risk

- What is basis risk?
- Many think it is something to do with the market loss or parametric trigger on a cat bond or ILW
- In fact the risk is far more fundamental than this - International Association of Insurance Supervisors' definition:

"The reinsurance cover might prove insufficient to adequately handle the risk in question because reinsurance needs have not been precisely identified."
- Essentially, basis risk is the risk that the protection strategy adopted will not sufficiently mitigate the buyer's gross losses
- Key is understanding & quantifying basis risk

Basis Risk – Traditional Reinsurance

- Traditional cat excess of loss reinsurance – known as Ultimate Net Loss (UNL)
- Availability & coverage may fall well short of requirements
- Reliant on catastrophe models, the quality of modelling and the underlying data quality
- Level of attachment and depth of cover i.e. 2004 frequency issue vs. 2005 severity issue
- Hours clause
 - Depends on both territory and peril
 - Typically 72 hours for wind, 168 for quake & flood
 - Many insurers unable to recover against RI for UK floods 2007 as two events, each too small to exceed excess

Basis Risk - Industry Loss Warranties

- Triggered when the industry loss exceeds a predetermined value – the industry trigger e.g. US Windstorm exceeding \$25bn
- Once triggered act as traditional cat excess of loss reinsurance
 - Attachment points typically very low e.g. \$10,000
- Risk of a large portfolio loss occurring when there is a small industry loss - protection not triggered
- No benefit to buyer of “positive” basis risk
 - e.g. price does not reflect possibility of cover triggering but not incurring a full limit loss
- The higher the trigger the greater the basis risk
- ‘Window’ ILW allow a pro-rata share of the limit to be triggered if the industry loss exceeds a lower predetermined trigger

Basis Risk – Catastrophe Bonds

- Swiss Re - 73% of US cat exposed bond issued in 2006 had an industry loss trigger
 - Total nationwide loss trigger: basis risk issues similar to ILWs
 - State-weighted loss trigger should be a closer match to the portfolio written = less basis risk than total nationwide trigger
- Most of the remainder had parametric triggers e.g. Saffir-Simpson scale, maximum sustained windspeed
 - Broad triggers such as SS scale typically have more basis risk than industry loss triggers
 - Tailored triggers carry less basis risk than broad triggers
 - For both need to have high level of confidence in the cat modelling
- May be multi-year = harder to adapt to changes in underwriting strategy

Basis Risk – Derivatives

- Impossible to generalise, depends on type of index and contract strike
- Not contracts of indemnity, so can benefit from “positive” basis risk
- **NYMEX CAT Risk Derivatives**
 - Triggered on Re-Ex index; aggregate of all values reported by PCS except earthquake and terrorism
 - Change in the index is the same for 1 x \$20bn event or 4 x \$5bn events
 - Risk that the portfolio aggregate annual cat losses will be high when aggregate industry losses are low

Basis Risk – Derivatives

- **Carvill Hurricane Index (CHI)**
 - CHI calculated for individual hurricanes based on storm radius and maximum sustained windspeed at point of landfall
 - No allowance for location of landfall – Miami Dade vs Cameron County, Louisiana give very different losses for the same index value
 - No landfall = no index value calculated
 - Highly dependent on cat modelling
 - Risk that parametric index will not be reflective of actual portfolio losses

Basis Risk – Derivatives

- **WindX**
 - Based on maximum wind speed over a year at selected monitoring stations
 - Currently only a handful of stations, plans for 200
 - Highly dependent on cat modelling
 - “The WindX™ parametric index will for the first time allow insureds, insurers, and reinsurers to separate hurricane hazard risk from the more uncertain property vulnerability risk.”
- **Deutsche Bank**
 - ILW-style derivatives – single event trigger
 - Risk as for ILWs

Basis Risk Analysis - Example

- Actual sample of a US portfolio including Florida
- Client required >US \$190m of traditional UNL cover xs 1 in 15 year event
- Portfolio has been modelled on the following bases:
 - No reinsurance (gross)
 - The required UNL programme (highest spend)
 - An ILW portfolio for the same limits
 - A derivative strategy:
 - 'in the money' call spread options
 - same approximate spend as ILW (using Black-Scholes)
 - based upon US\$35bn anticipated annual aggregate losses
 - RMS medium term estimate for US Hurricane, Tornado, Hail = US\$21bn
- Where graph goes below zero = profit from derivative strategy where there are large market losses but small losses to the company portfolio

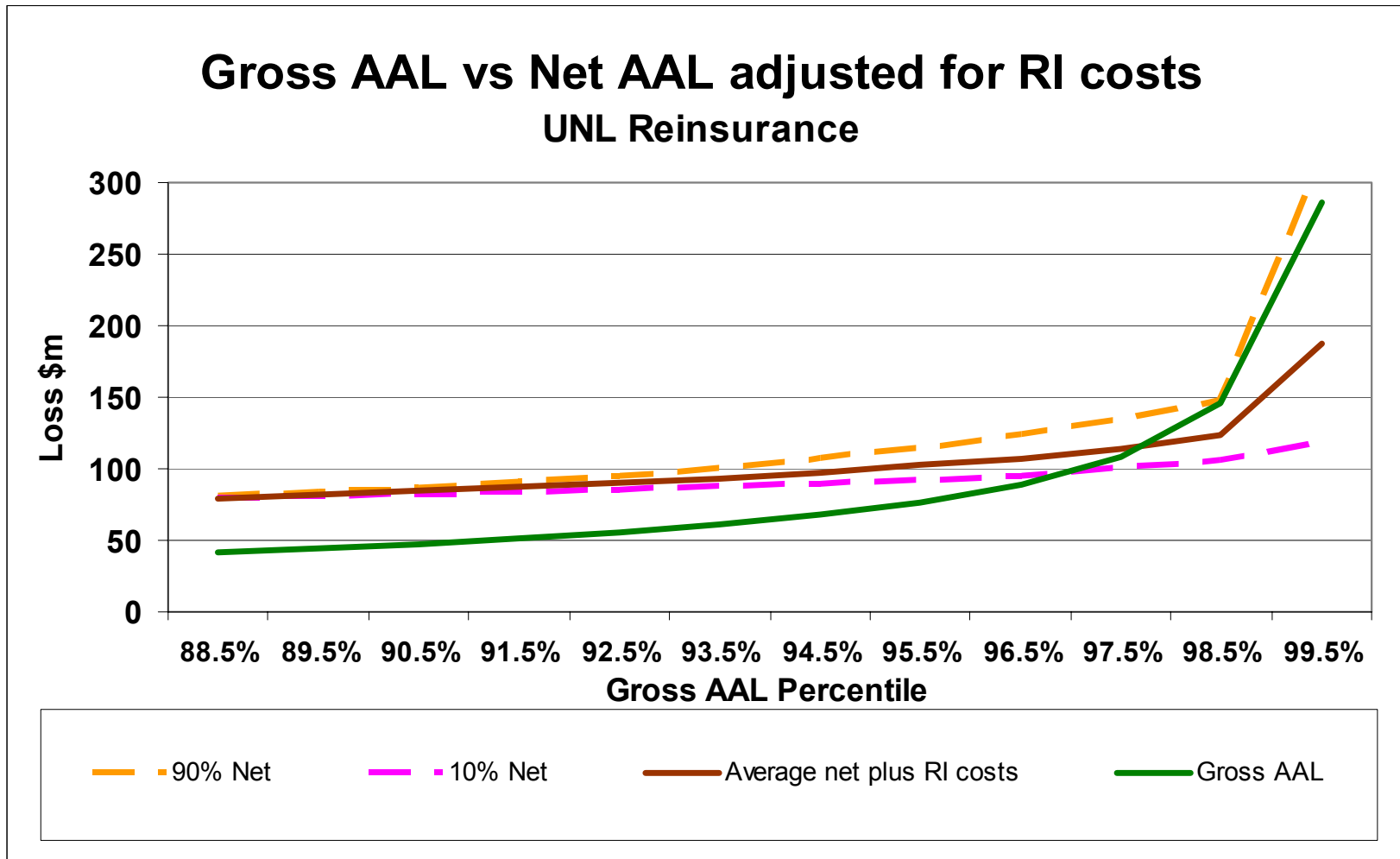
Basis Risk Analysis – Key Assumptions

- Allows for secondary uncertainty for each of the synthetic events in the event loss table
- Correlates secondary uncertainty percentile for market and portfolio loss
 - 80% for hurricane
 - 65% for tornado
- Includes an unbiased error function for the difference between modelled market loss and PCS loss
- 50,000 iterations / Latin Hypercube as we need to examine extremes
- Allows for cost of protection (RI premium or option cost) plus paid, limited reinstatements on reinsurance programmes

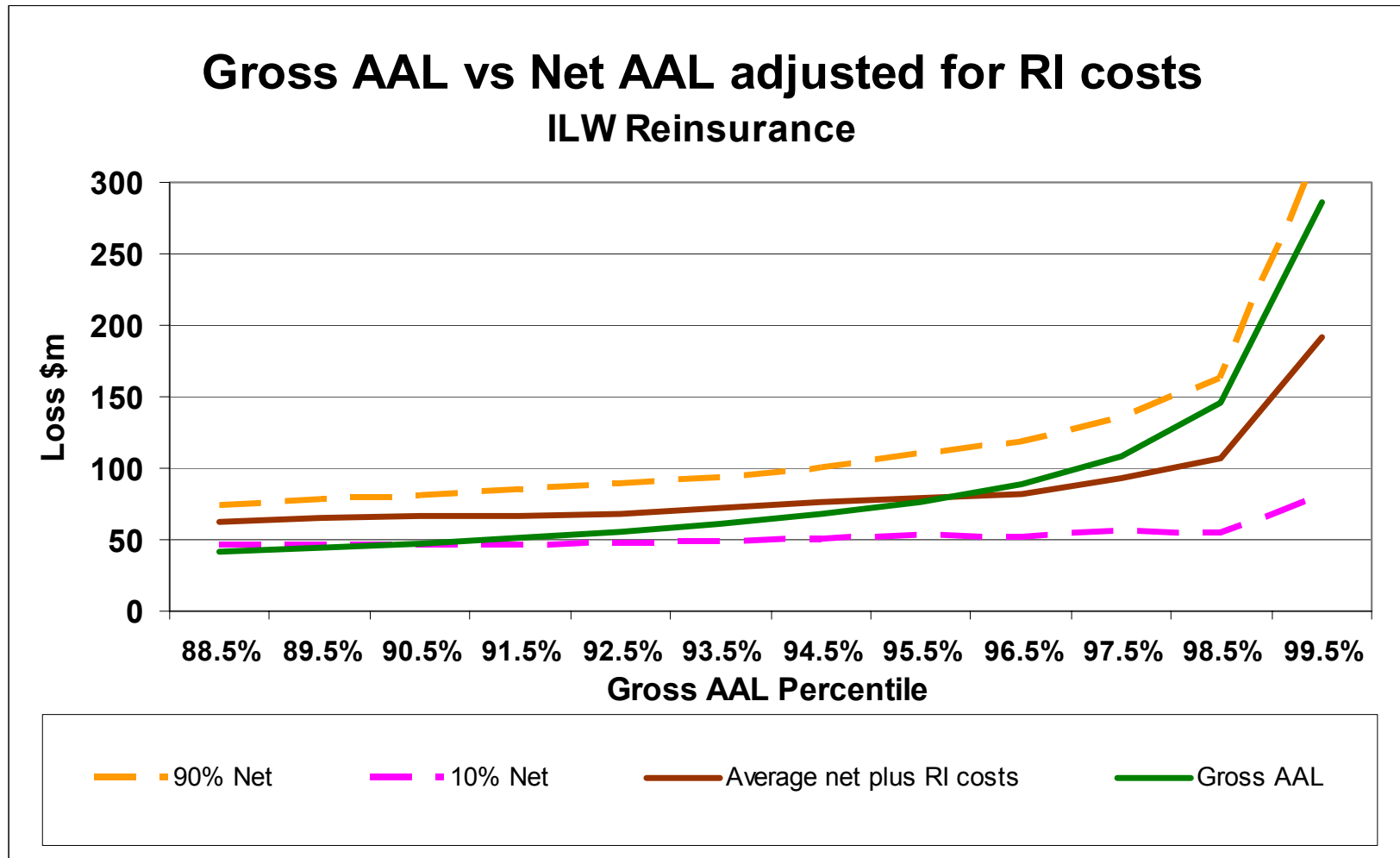
Basis Risk Analysis – Key Findings

- Each 1% percentile band on the gross portfolio claims value represents 500 simulated years
- For each of the simulated years in each of the bands we have identified the corresponding net claims value for the three protection strategies considered
- The following graphs show the average of these net claims values for each gross claims percentile band, plus the 10th and 90th percentiles
 - Allows us to investigate the “upside” and “downside” in the possible net outcomes for a given gross outcome
- In this case, the derivative strategy appears to more closely match the annual aggregate gross claims than the UNL or ILW strategies

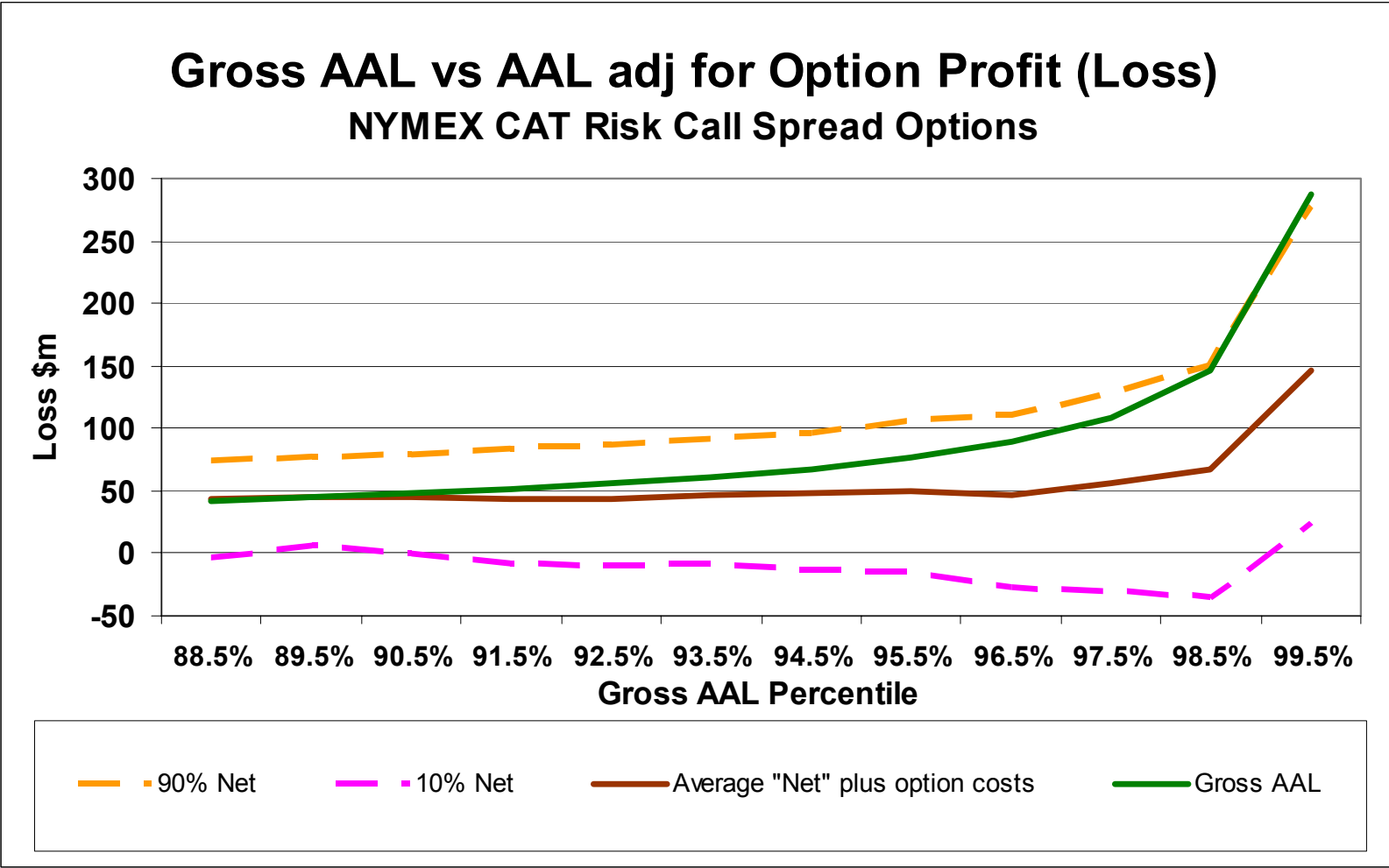
Gross Cat Losses vs Net UNL Strategy



Gross Cat Losses vs Net ILW Strategy



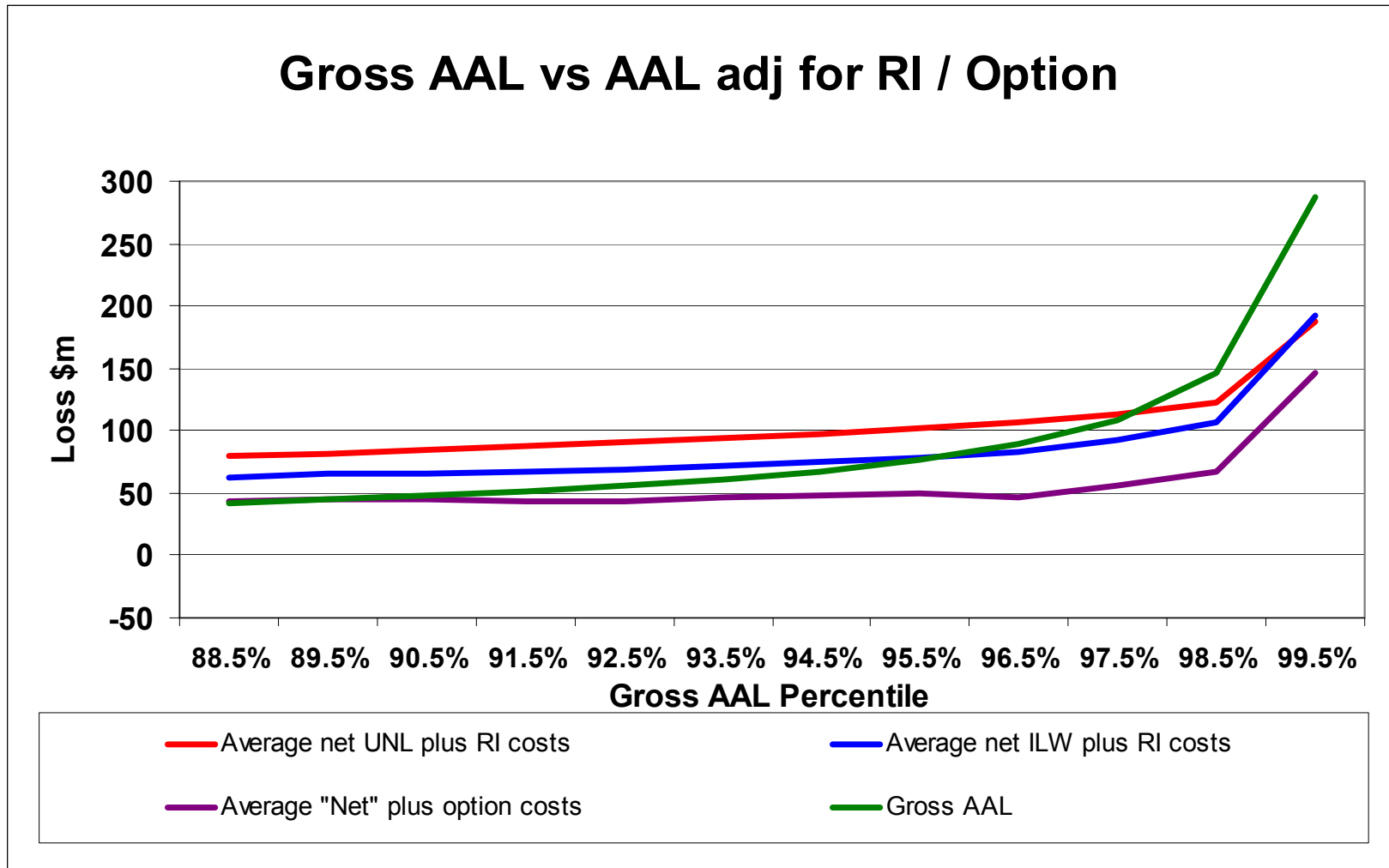
Gross Cat Losses Vs Net of Derivative Strategy



Based on market estimated final index value of \$3500.00 = market loss of \$35bn
 Call Spread options priced on Black-Scholes formula

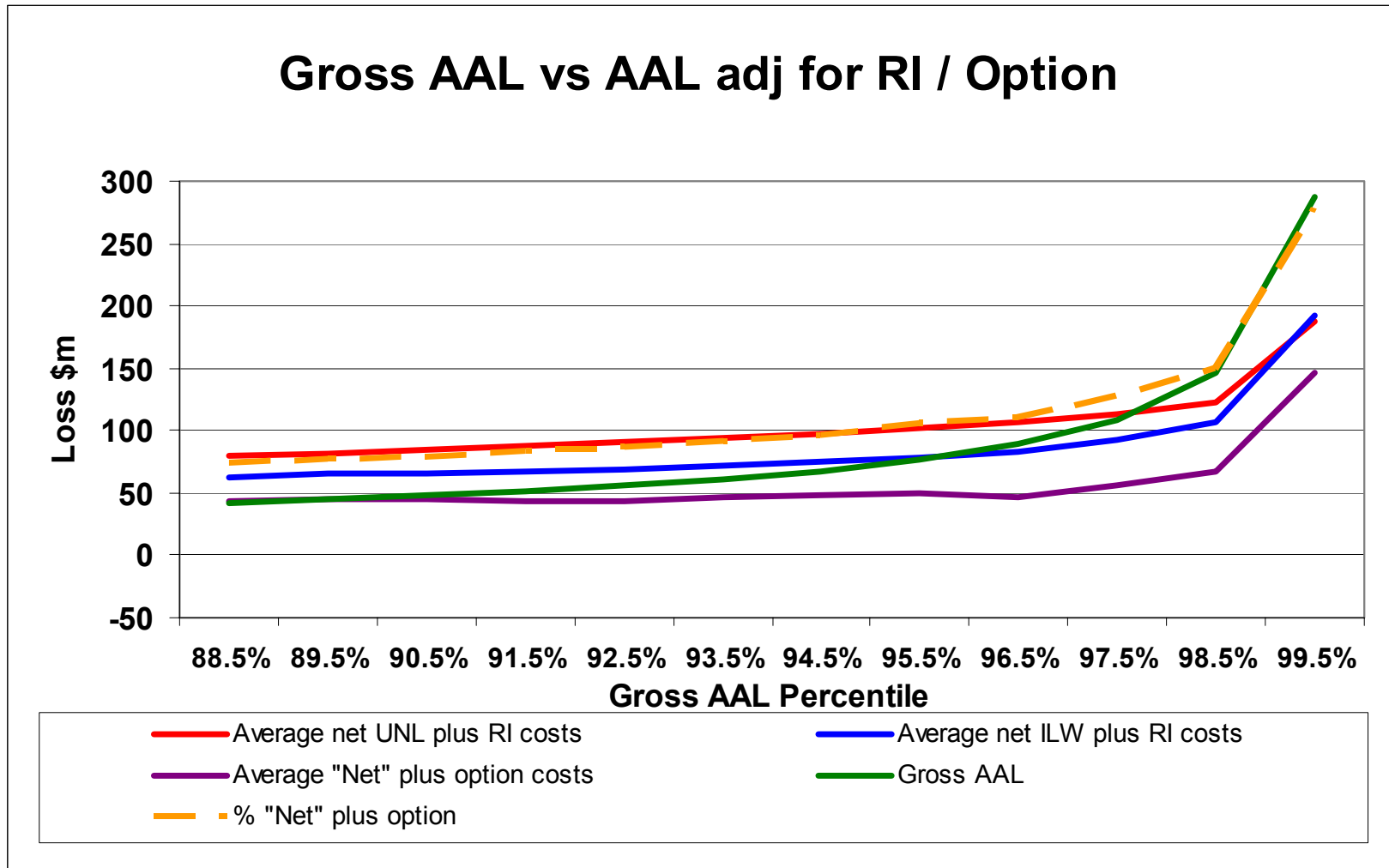
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Gross Cat Losses Vs Net Comparison



Based on market estimated final index value of 3500.00 = market loss of \$35bn
 Call Spread options priced on Black-Scholes formula

Gross Cat Losses Vs Net Comparison



Based on market estimated final index value of 3500.00 = market loss of \$35bn
 Call Spread options priced on Black-Scholes formula

Market Reactions

- Launch date (March 07) selected with view to educating potential buyers & seller prior to 1/1/2008 renewals
- Over 100 presentations to individual companies on the NYMEX CAT Risk contracts
- Insurance Insider breakfast briefing “Trading Risk” attended by 300 (re)insurance and finance executives
- First trade already done on NYMEX CAT Risk contracts
- Requests for additional contracts
- We anticipate that initially trading will be driven by the OTC market
- Many reinsurance buyers advise they plan to utilise for 2008

Market Reactions

“one of the great and exciting stories of financial innovation in the next five to ten years”

Michael Spencer, founder and chief executive of the world’s largest inter-dealer broker, ICAP

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