Some New Insights into Large Commercial Risks

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AGENDA

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A new data source: **Imperial-IICI dataset**

- Insurance Intellectual Capital Initiative (IICI)
    - Bronek Masojada (Hiscox), James Slaughter (Liberty Mutual), Rob Caton (Hiscox)
    - Lloyd's of London
- Focus on Large Commercial Risks (LCR)
    - Commercial Property, On-shore Energy; non-natural hazards

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OVERVIEW

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Implications for **reserving** and capital **modeling** (joint work with Davide Benedetti, Erik Chavez [Imperial]; with Andreas Milidonis [Nanyang] for Asia-Pacific region)

- Tail risk estimation
- Benchmarking exercise (market loss curves & scaling factors)

LCR

LCR largely **non-modelled** risks

- Heterogeneity of exposures by type and size
- Complex relation between hazard events and losses
- Paucity of data for model estimation/validation

Implications

- Considerable degree of judgment in pricing/reserving decisions
- Reported claims may not reflect true risk of business
- Pricing variability makes it difficult for corporates to budget for insurance

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DATASET

- Around **3,200** **FGU claims** and **exposures** based on brokers' submissions
- Scope: **worldwide, 1999-2012**

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- Around **3,200 FGU claims** and **exposures** based on brokers' submissions
- Scope: **worldwide, 1999-2012**
- Granular classification of exposures by three **occupancy levels**
  - Definitions based on Lloyd's codes & individual syndicates' classification; can be related to ISO/PSOLD classification
- Anonymized **claim narratives** available
- Example:

Region	Country	Risk Code	Occupancy 1	Occupancy 2	Occupancy 3
NoA	US	P2 (Physical damage for primary layer property; USA; excluding binders)	CO (commercial)	R (residential)	51 (Large Hotels)

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Code	Definition	Code	Definition
A	Miscellaneous	Q	Offices/Banks
B	Manufacturers/Processors	R	Residential
C	Chemicals/Pharmaceuticals	T	Transport
D	Bridges/Dams/Tunnels/Piers	U	Utilities
E	Conglomerates	V	Telecoms and Data Processing
F	Food	W	Woodworkers (Sawmills, Papermills)
G	Grain	X	Onshore Crude
H	General Mercantile/Shops	Y	Onshore GasPlants
J	Mines	Z	Onshore Construction
K	Crops	2	Hospital/Health care centres
L	Auto	4	Semiconductor/Fabs
M	Metals	5	Motor Manufaturers
O	Municipal Property	6	Warehouses
P	Energy (Oil Refineries/Petrochemicals)		

GEOGRAPHICAL/OCCUPANCY SPLIT
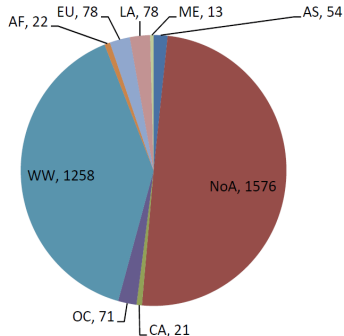
AF (Africa), CA (Central Asia), EU (Europe), LA (Latin America), ME (Middle East), AS (Asia-Pacific), NoA (North America), OC (Oceania), WW (Worldwide).
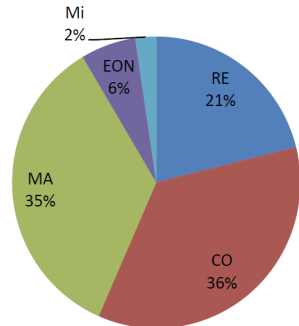
RE (Residential), CO (Commercial), MA (Manufacturing), EON (Energy on-shore), Mi (Miscellaneous).

OCCUPANCY SPLIT BY CLAIM SIZE
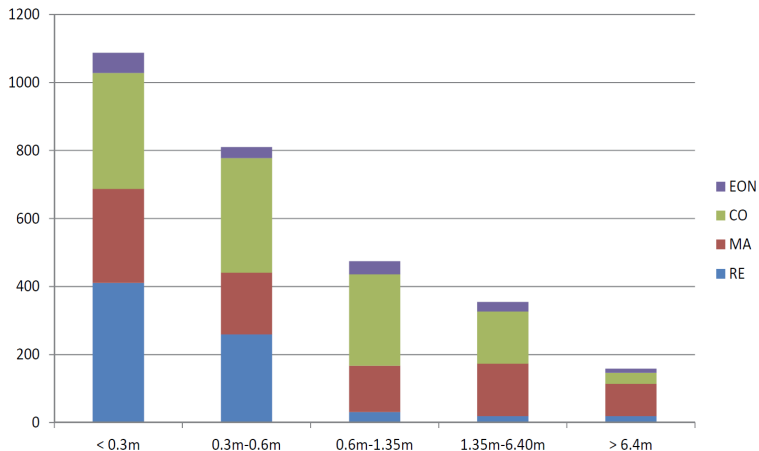
OCCUPANCY SPLIT BY TIV
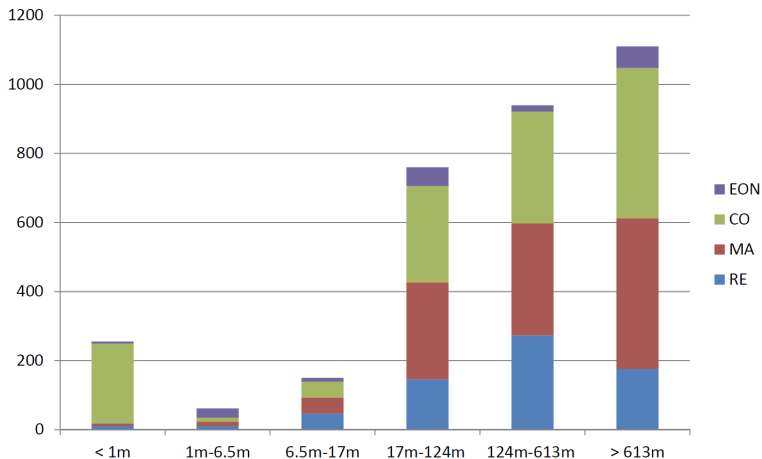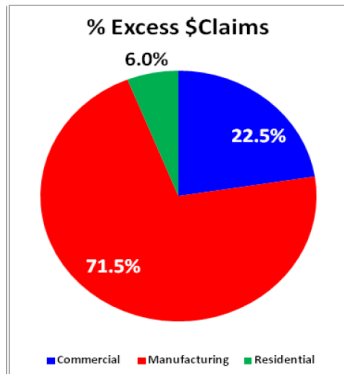
OCCUPANCY SPLIT BY LOCATION
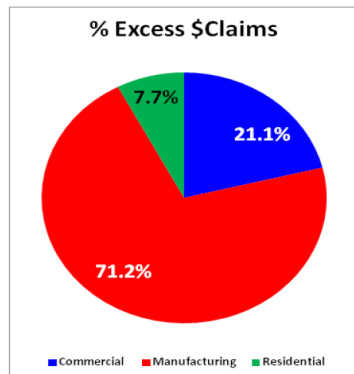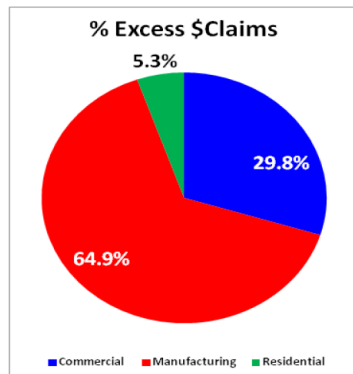
North America   Rest of the World

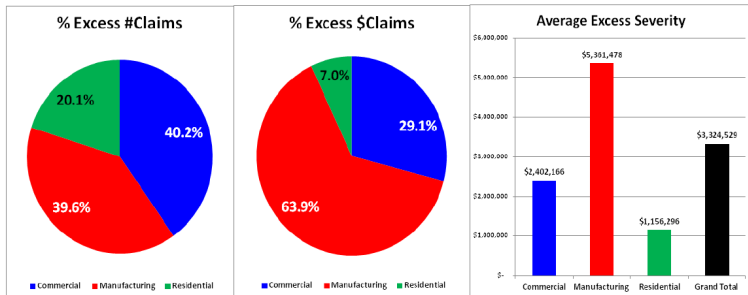FGU claims > USD 1m

OCCUPANCY SPLIT BY LOCATION

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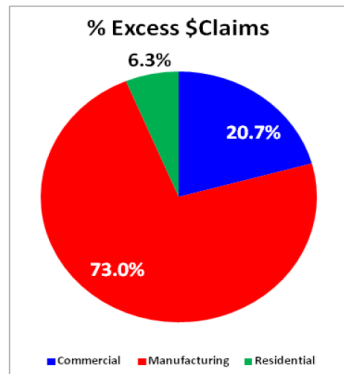
Rest of the World

FGU claims > USD 5m

VALIDATION

- Imperial-IICI data vs. Property Size-of-Loss Database (PSOLD) [John Buchanan (ISO-Verisk)]
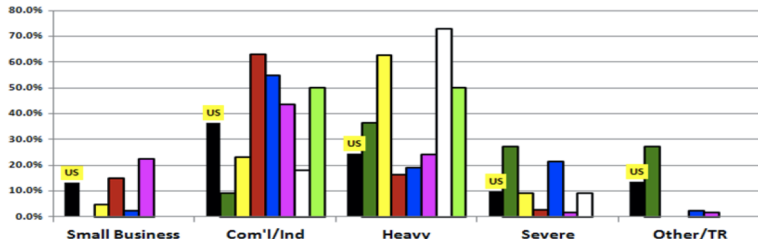

All FGU claims

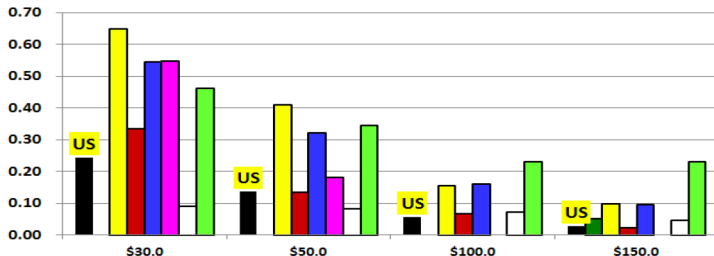## VALIDATION

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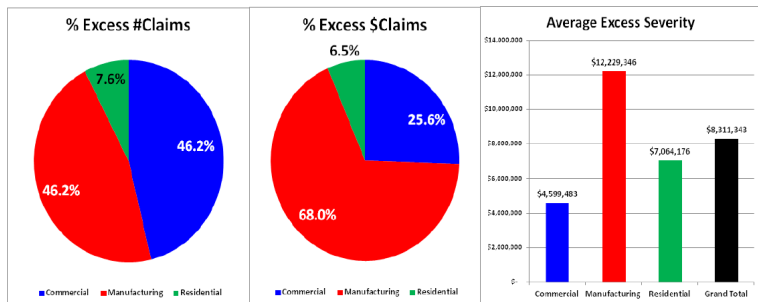
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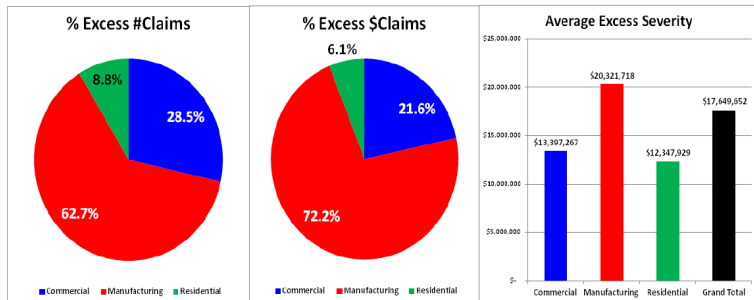
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VALIDATION - **Cross-occupancy comparison**

- Imperial-IICI data vs. Property Size-of-Loss Database (PSOLD) [John Buchanan (ISO-Verisk)]

Source: National Fire Protection Association as compiled by ISO Verisk.

VALIDATION - **Cross-country comparison**

- Imperial-IICI data vs. Property Size-of-Loss Database (PSOLD) [John Buchanan (ISO-Verisk)]

- Using US as the base, compare # of large claims per \$B of total commercial property premium in excess of various thresholds. Shown are thresholds ranging from \$30M to \$150M
- Although varies significantly by country, the number of large claims on average is 40-50% higher than the US for these largest claims
- Protection/ sprinkler differences may account for a significant portion of the US vs. non-US experience

Source: National Fire Protection Association as compiled by ISO Verisk.

VALIDATION - **NoA**

- Imperial-IICI data vs. Property Size-of-Loss Database (PSOLD) [John Buchanan (ISO-Verisk)]

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TAIL RISK

Tail index (α) estimation: $\mathbb{P}(Z > z) \sim Cz^{-\alpha}$

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- Existence of **centered moments** (mean, variance, etc.)
  - Mean/Variance finite if and only if $\alpha > 1$ ($\alpha > 2$)

- Extent of **diversification** benefits for quantile-based risk measures
  - Retain fractions $w_1, \ldots, w_n$ of risks $X_1, \ldots, X_n$
  - Resulting aggregate risk $Z_{(w_1,\ldots,w_n)} = \sum_i w_i X_i$
  - $VaR_p(Z_{(1,0,\ldots,0)}) < VaR_p(Z_{(\frac{1}{n},\ldots,\frac{1}{n})})$ for $\alpha \in (0,1), p \in (0,1/2)$, for stable distributions (e.g., Ibragimov, 2009)

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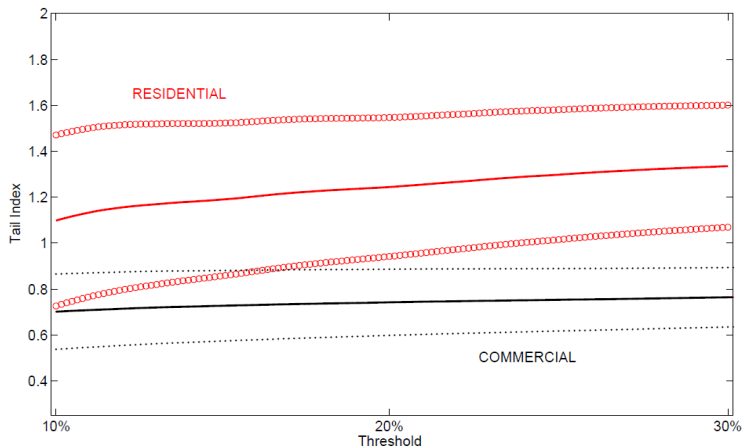
What do we find for LCR?

- Heavy tails & significant heterogeneity across occupancy type

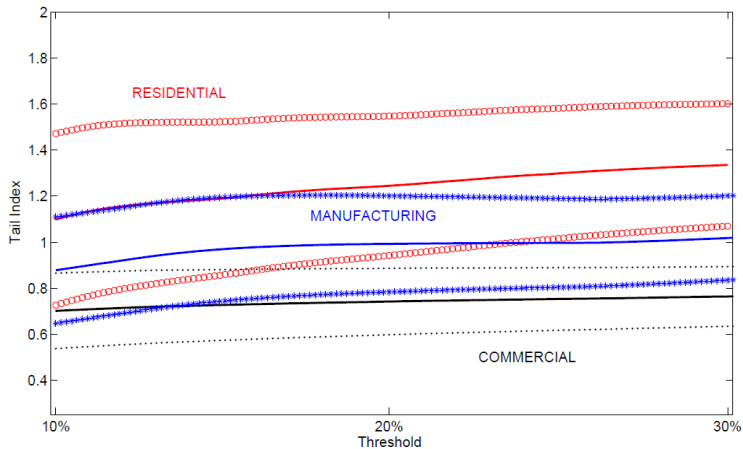## RESIDENTIAL EXAMPLE: HILL vs. LLRS-1/2
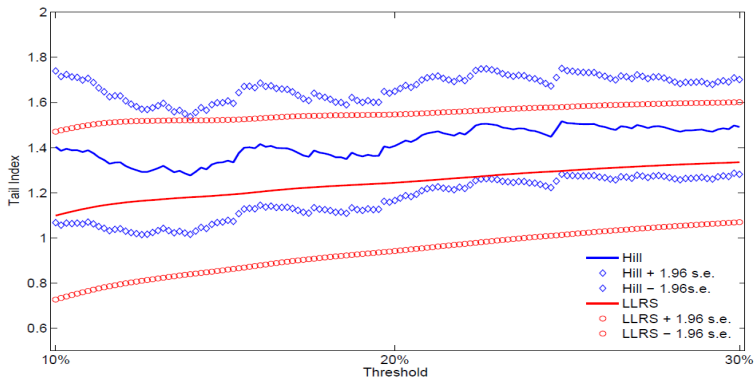
Hill (1975) vs. Gabaix-Ibragimov (2011)'s log-log rank-size regression method with optimal ranks shift -1/2 and correct standard errors.
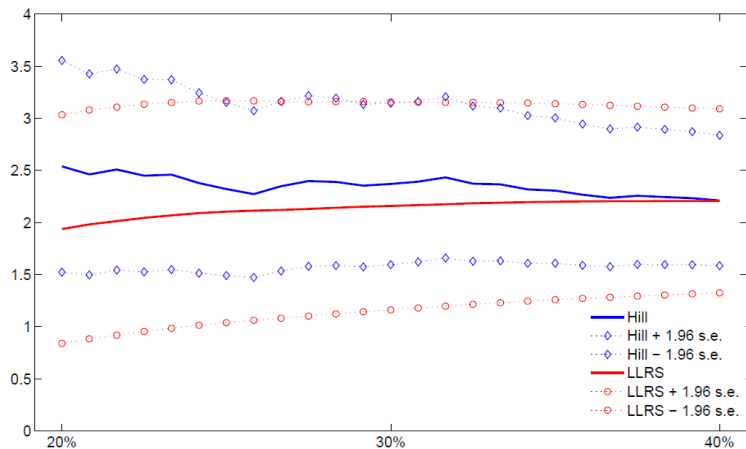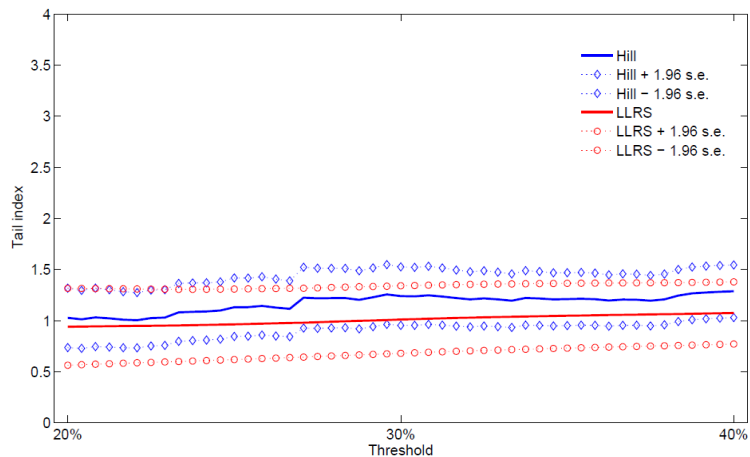
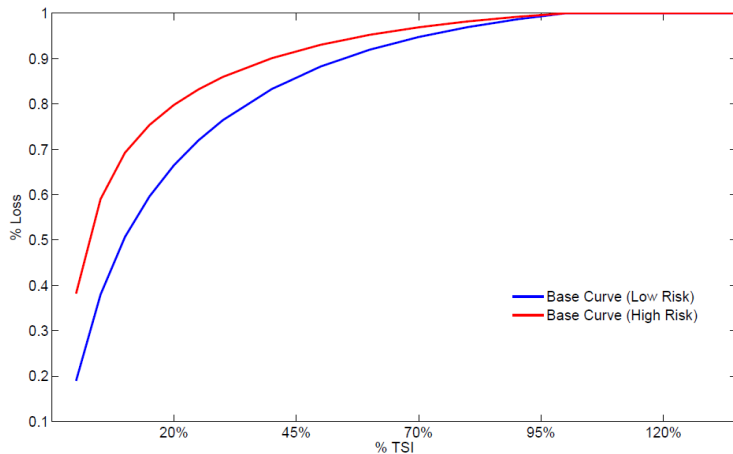## OCCUPANCY TYPE

OCCUPANCY TYPE

OCCUPANCY LEVEL 3 - Hotels

OCCUPANCY LEVEL 3 - Condos & Housing Associations

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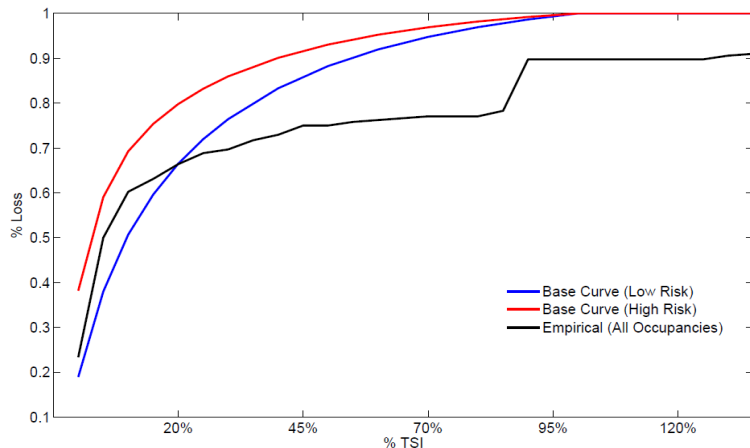
1. Overview

2. Dataset

3. Estimation

4. Benchmarking

5. Conclusion

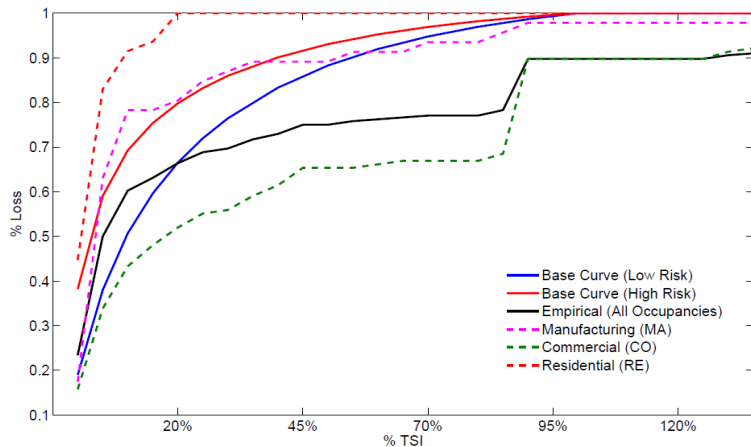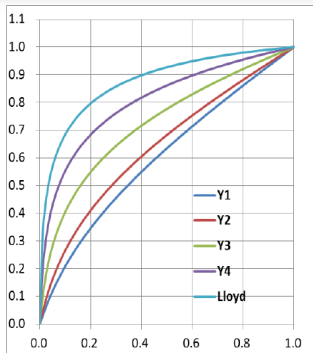## BENCHMARKING EXERCISE - A SPECIFIC TIV BAND
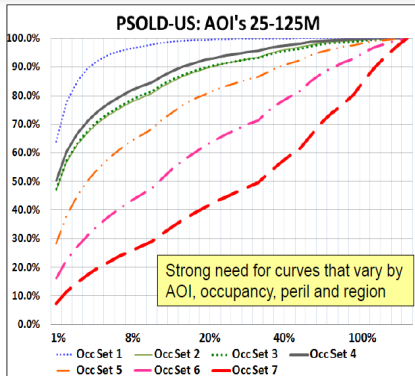
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LOSS CURVES HETEROGENEITY

Source: China Re CPCR curve comparison
MBBEFD (Y1-Y4) parametric approximation;
Lloyd's empirical from unknown data source

PSOLD has over 1 million individual curves
for 60 AOI bands, 38 occupancies, 4 sets of
perils, 50 states, etc.; some collapse to
between 500 and 1,000 curves

Source: John Buchanan (ISO-Verisk).

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CONCLUSION

New data source for LCR

- Robust estimation of **tail risk**
- **Comparing** claim costs across occupancy/TIV bands/location

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Lessons from Imperial-IICI data collection, validation, and analysis

- Link between claims and exposures crucial: Systematic storage of claims & exposures information (policy schedules & claims narratives in digital, compatible format) should be a priority
- Macro-validation (e.g., Fire Protection Agencies) & micro-validation (e.g., syndicate level) of data important for *structural* understanding of risk
- Gains from data aggregation HUGE - **please contribute!**

OCCUPANCY LEVEL 1 'CO': AN INSURER
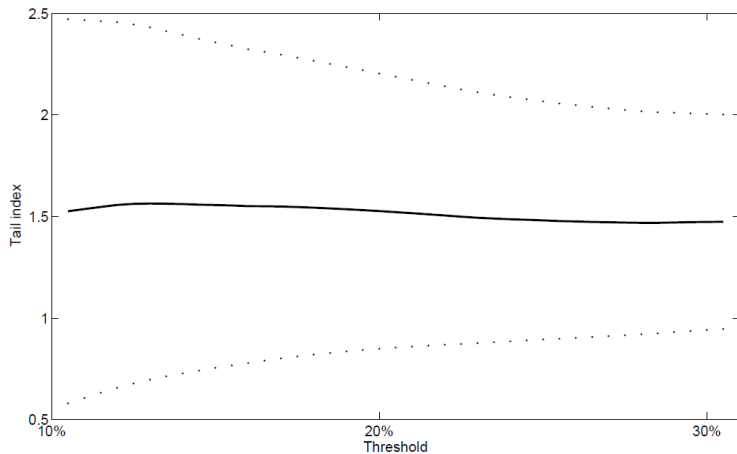
OCCUPANCY LEVEL 1 'CO': MULTIPLE DATA SOURCES
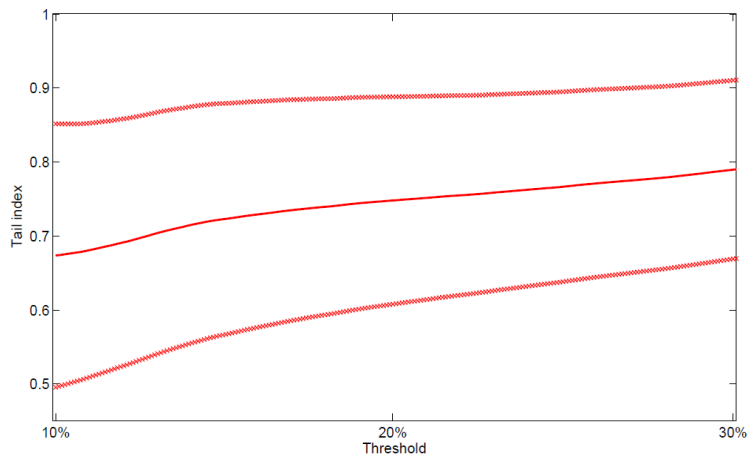
WORK IN PROGRESS (ASIA-PACIFIC REGION) & NEXT STEPS

Insurance Risk & Finance Research Centre
at Nanyang Business School Singapore

www.irfrc.com

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THANK YOU

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