Structure and Complexity of Global Insurance Groups

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Background: Global Insurance Market

> *"Hence any Pareto-optimal set of treaties is equivalent to a pool arrangement, i.e. all companies hand their portfolios over to a pool, and agree on some rule as to how payment of claims against the pool shall be divided among the companies."*
>
> ***Karl Borch**, Econometrica 1962*

Yet the biggest balance sheets today belong to **primary insurance groups**, not pure reinsurers.

Rank	Group	Assets (USD bn)
1	**Ping An Insurance (Group) Co. of China**	1592.1
2	**Allianz SE**	1290.5
3	**Berkshire Hathaway Inc.**	958.8
	...	
28	**Swiss Re AG**	181.6
	...	
35	**Munich Re (Münchener Rück AG)**	128.1

Source: Orbis, 2023

Background: Global Insurance Growth vs. Protection Gap

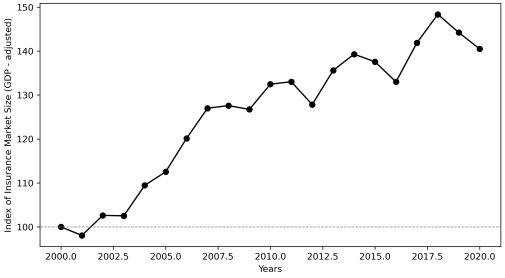

Figure: Insurance Market Index—total assets.*Source: ORBIS*

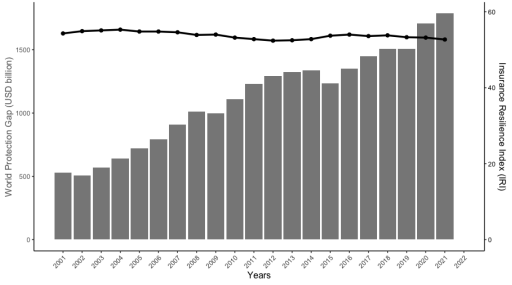

Figure: Global protection gap (*bars*) and Resilience Index (*line*). *Source: Swiss Re, 2023*

- While the insurance sector's balance-sheet capacity has more than doubled since 2000, the protection gap has widened—indicating that asset growth alone is not closing unmet coverage needs in absolute terms.

Background: Concentration of Headquarters in the Insurance Market

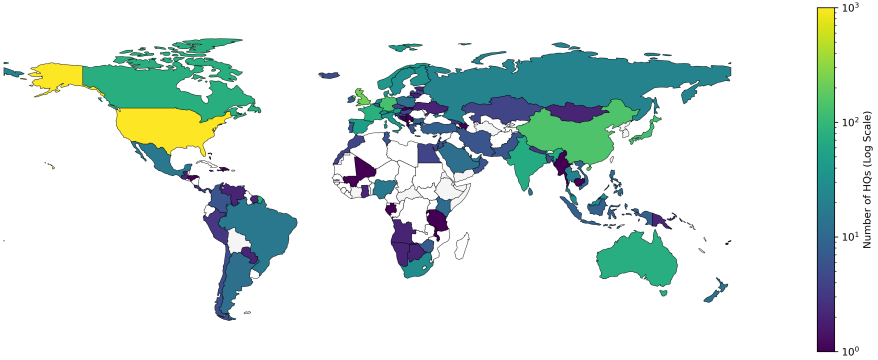

Figure: Global distribution of insurance-group headquarters per country (log scale).

- 77% of the 2,455 groups' HQs sit in advanced markets (Asia, Europe,North America), highlighting the dominance of established financial centres.

Background: Concentration of Subsidiaries in the Insurance Market

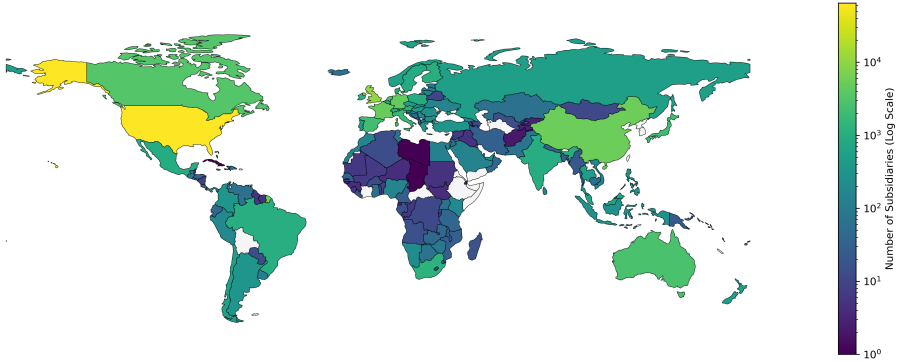

Figure: Global distribution of insurance-group subsidiaries per country (log scale).

- Advanced-economy groups command 84% of the 110,481 subsidiaries underscoring their outsized global influence.

Research Questions

Research Agenda

1. What is the structure of the global insurance market? Is it compatible with the optimal risk sharing structure predicted by the theory?
2. What factors shape the geographic, jurisdictional, and business footprint of insurance groups?
3. Do regulatory regimes, capital controls, and offshore activities amplify or mitigate the insurance protection gap?

Research Questions Addressed in This Presentation

1. Does business, jurisdictional, distance complexity improve or diminish group performance? How do reinsurance activities offset or reinforce complexity's impact on performance?
2. How do regulatory factors such as capital controls and various regulatory regimes affect performance?
3. Does organizational complexity facilitate expansion to markets with significant protection gap, e.g., emerging markets?

Outline

Data

Does Complexity Lead to Better Performance?

What are the Drivers of Offshore Expansion?

Does Complexity Help to Resolve Protection Gap?

Are the Same Factors Driving Expansion to Advanced and Emerging Markets?

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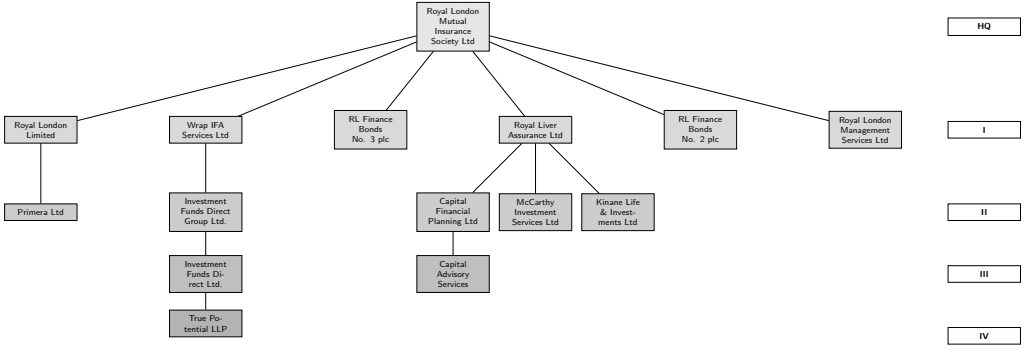
Observations: Corporate Trees



Data on Corporate Structures and Ownership

- Comprehensive sample from three main providers (1980-2024):
  - S&P Capital IQ Pro (over 4 million entity-year observations)
  - ORBIS Insurance Focus (additional 1.25 million entity-year observations)
  - Reuters M&A (via WRDS) for smaller or less-frequently reported deals
- Focus on majority shareholdings (>50%), capturing controlling interests in:
  - Life and health insurers
  - Property and casualty insurers
  - Reinsurers
  - Allied financial subsidiaries
  - Non-Financial subsidiaries
- Over 110,000 subsidiaries operating in 208 countries/offshore territories
- Combined total assets of sampled companies exceed USD 35 trillion
  - Global insurance market reached over USD 35.73 trillion in 2023, Financial Stability Board.
- For corporate structure and financial details (2000–2023):
  - Over 2 million entity-year observations
  - Standardized identifiers (LEIs, etc.) facilitate matching with other datasets

Data on M&A, Protection Gaps, and Aggregate Indicators

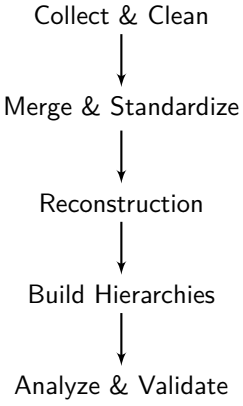
- M&A data span 45 years (1980–2024), capturing 62,001 deals
  - Data reconstructed to include ownership changes/history
- Data on insurance protection gap and resilience:
  - Source: Swiss Re
- Data on domestic insurance markets and macroeconomic indicators:
  - Sources: OECD, IMF, World Bank

Reconstruction Procedure of Organizational Ownership

Why Reconstruct Global Insurance Group Hierarchies?

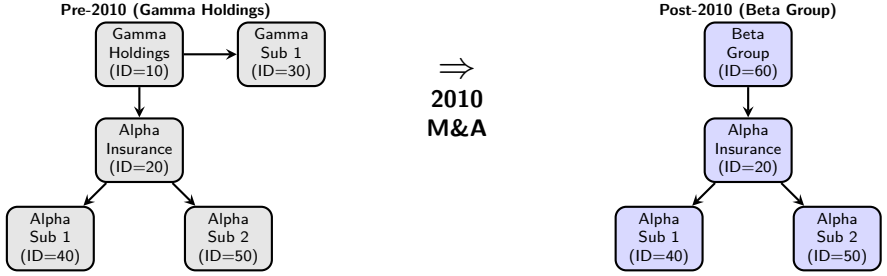
- **Objective:** Build a backward-looking map of insurance groups's organizational ownership structure (1980–2024).

Visual Workflow:



- **Collect & Clean:** Gather ownership + M&A data; remove inconsistencies.
- **Merge & Standardize:** Unify data into a common schema (IDs, formats).
- **Reconstruction:** Reconstruct historical ownership (1980–2024).
- **Build Hierarchies:** Recursively link parent-child relationships.
- **Analyze & Validate:** Check for loops, measure structure (size, depth).

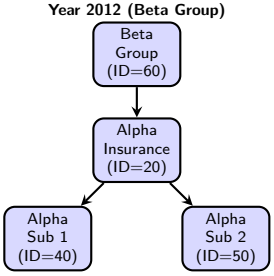
Historical Reconstruction of Ownership Structure



- Until 2009, parent_id(20) = 10.
- `Gamma Sub 1` stays under `Gamma Holdings`.

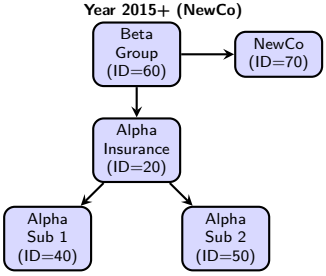
- From 2010 onward, parent_id(20) = 60.
- `Gamma Holdings` no longer owns `Alpha Insurance`.

Historical Reconstruction of Ownership Structure



- parent_id(20) = 60 from 2010 onward.
- `NewCo` (ID=70) not yet established.

⇒ **2015 Founded**



- Post-2015, parent_id(70) = 60.
- `NewCo` is introduced with direct ownership by `Beta Group`.

Levenshtein Similarity

Hierarchical Path (HP) vs. Adjusted Hierarchical Path (AHP):

- **HP:** Direct ownership chain (e.g., 1001–1002–1003).
- **AHP:** Same chain but extended to a fixed max level (e.g., 1001–1002–1003–0–0 if max depth=5).
- Facilitates standard length for string-based similarity.

Levenshtein Ratio (LR):

$$\mathrm{LR}(s,t) = \frac{(|s| + |t|) \; - \; d_{\mathrm{Lev}}(s,t)}{|s| + |t|},$$

where d_{Lev} is the minimum number of path edits (insertions, deletions, substitutions) to transform s into t.
Ratio range: $[0, 1]$, with $1 =$ identical paths.

	S&P 2017 vs. SP		S&P 2017 vs. ORBIS		SP vs. ORBIS	
Metric	**AHP**	**HP**	**AHP**	**HP**	**AHP**	**HP**
Average Similarity	79.85%	80.09%	71.28%	68.92%	73.75%	72.94%

Measures of Complexity

Jurisdictional Complexity

- A Herfindahl-based index measuring how subsidiaries are distributed across geographic regions, computed annually for group j in year t over R possible regions. $R = 9$ (broad regional classification, e.g. Advanced North America etc.) or $R = 208$ (every country)

$$JC_{j,t} = \frac{R}{R-1}\left(1 - \sum_{r=1}^{R}\left(\frac{\text{count}_{j,t}^{r}}{\text{totalcount}_{j,t}}\right)^2\right).$$

Business Complexity

- A Herfindahl-based index capturing dispersion across six business lines: Life & Health, Property & Casualty, Reinsurance, Banking, Other Financial, Non-Financial. For group j in year t over $T = 6$ lines,

$$BC_{j,t} = \frac{T}{T-1}\left(1 - \sum_{i=1}^{T}\left(\frac{\text{count}_{j,t}^{i}}{\text{totalcount}_{j,t}}\right)^2\right).$$

- Both indices range from 0 to 1, where higher values indicate more uniform business diversification.

Distance Complexity

- Focuses on the physical dispersion of a group's subsidiaries via mean pairwise distances within the group
- Distances computed using the Haversine formula for latitude/longitude pairs:

$$d_{i,k} \;=\; 2\,R\,\arcsin\!\Bigg(\sqrt{\sin^2\!\Big(\tfrac{\phi_k-\phi_i}{2}\Big)+\cos(\phi_i)\cos(\phi_k)\,\sin^2\!\Big(\tfrac{\lambda_k-\lambda_i}{2}\Big)}\Bigg),$$

- Average raw distance for group j in year t:

$$\overline{d}_{j,t} = \frac{2}{N_{j,t}\,(N_{j,t}-1)} \sum_{i=1}^{N_{j,t}-1} \sum_{k=i+1}^{N_{j,t}} d_{i,k}.$$

- Normalized index:

$$\hat{d}_{j,t} = \frac{\overline{d}_{j,t} - \overline{d}_{\min,t}}{\overline{d}_{\max,t} - \overline{d}_{\min,t}}, \quad 0 \le \hat{d}_{j,t} \le 1.$$

Annual Jurisdictional Complexity

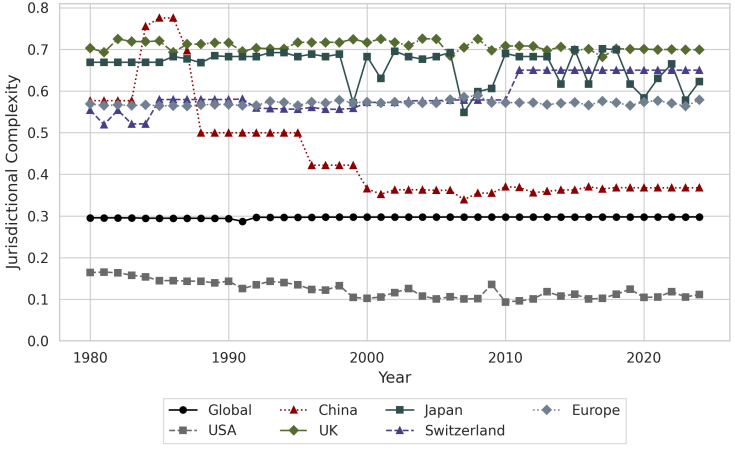


Figure: Annual Jurisdictional Complexity by Headquarters Region

Annual Distance Complexity

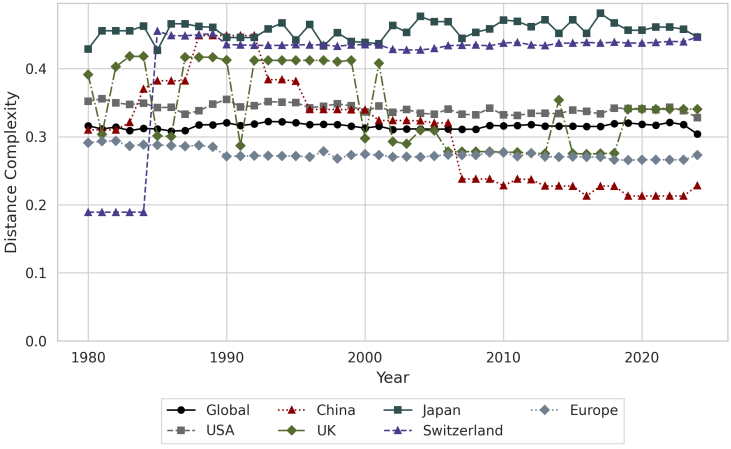


Figure: Annual Distance Complexity by Headquarters Region

Map of Jurisdictional Complexity

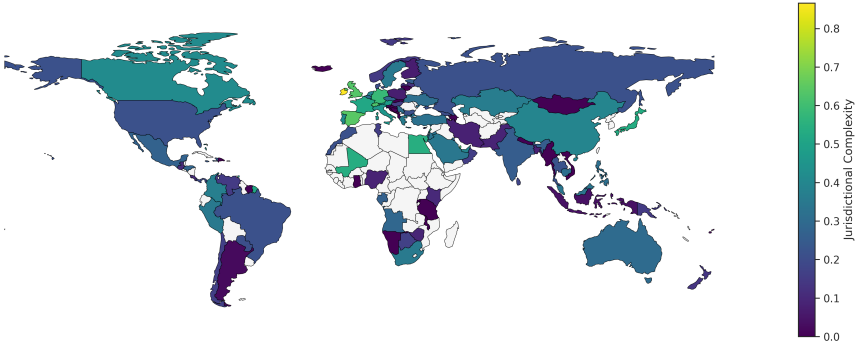


Figure: Average Jurisdictional Complexity by Country (1980–2024)

Shares by Region of Ultimate Ownership

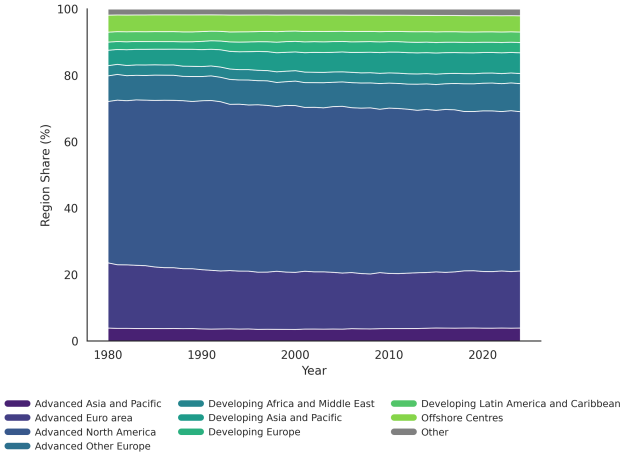


Figure: Shares of Ultimate Ownership by Geographical Region (1980–2024)

Data

Does Complexity Lead to Better Performance?

What are the Drivers of Offshore Expansion?

Does Complexity Help to Resolve Protection Gap?

Are the Same Factors Driving Expansion to Advanced and Emerging Markets?

Empirical Analysis

- **Coverage:** 110'000 subsidiaries in 208 jurisdictions (2000–2021).
- **Panel:** Over 2 million entity-years / 68'604 group-years.
- **Research Questions:**
  - Does Complexity Lead to Better Performance?
  - What are the Drivers of Offshore Expansion?
  - Does Complexity Help to Resolve the Protection Gap?
  - Are the Same Factors Driving Expansion to Advanced and Emerging Markets?

Endogeneity and Instrumental Variables Approach

- **Endogeneity** — Insurance groups shape their subsidiary networks *and* profitability simultaneously, so complexity is not exogenous.
- **Identification need** — OLS confounds reverse causality and omitted factors; we require an external source of variation to isolate the causal effect of complexity.

Instrument: Distance to Insurance Hubs

- **Definition** — average great-circle distance from each subsidiary to the *nearest* global hub (London, New York, Zurich, Munich, Tokyo, Hong Kong, Singapore, etc.):

$$\mathrm{IV}_{j,t} = \min_{i=1,\ldots,N_{j,t}} \min_{h \in \mathcal{H}_{\mathrm{GFCI}}} d\big(\mathrm{Entity}_i,\, h\big),$$

- **Economic logic** — farther distance ⇒ weaker local agglomeration benefits (capital, expertise, brokers) ⇒ firms have less complex structures.
- **Exogeneity** — subsidiary footprints are sticky (regulatory barriers, relocation costs), so distance is predetermined and slow-moving.
- **Exclusion** — once complexity is controlled for, distance should have no direct effect on performance or risk beyond the agglomeration channel.

First-Stage Regressions: Instrument Validity

First Stage	Business Complexity	Distance Complexity	Jurisdictional Complexity by Region	Jurisdictional Complexity by Country
Min. group distance to hub (km)	$-5.47\times10^{-6***}$	$-6.90\times10^{-6***}$	$-6.70\times10^{-6***}$	$-8.43\times10^{-6***}$
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations Groups	68 604	68 604	68 604	68 604
R^2	0.1389	0.1703	0.0110	0.0259
Partial F (instrument)	39.13	71.94	18.61	30.26
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- Instrument is a strong negative predictor of all complexity measures, as partial F-statistics indicate.

Does Organisational Complexity Create or Destroy Value?

Research Question:

- Which dimension of complexity—product scope, spatial reach, or legal fragmentation—has the strongest effect on insurance groups' performance?

Regression Model (2SLS):

$$\text{Performance}_{i,t} = \beta_0 + \beta_1 \widehat{\text{Complexity}}_{i,t} + \sum_{\ell=1}^{L} \gamma_\ell \, \text{Controls}_{i,t}^{\ell} + \mu_i + \theta_t + \varepsilon_{i,t}.$$

Controls:

- **Firm characteristics:** ln(Assets), Cash Flow, Current Ratio, Employees
- **Macroeconomic factors:**
  Financial Development Index, Short-Term Rate, Bond Yield, GDP Deflator

Result 1 (a): Complexity and Performance: ROA

Panel A: ROA	(1)	(2)	(3)	(4)
$\widehat{\text{Business Complexity}}$	-0.0442***			
	(-8.410)			
$\widehat{\text{Distance Complexity}}$		-0.0526***		
		(-10.188)		
$\widehat{\text{Jurisdictional Complexity}}$			-0.0802***	
			(-22.074)	
$\widehat{\text{Jurisdictional Complexity By Country}}$				-0.0638***
				(-21.909)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	68, 604	68, 604	68, 604	68, 604
R^2	0.0258	0.0270	0.0293	0.0293
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- Broader business scope decreases operating profitability, and geographic or legal sprawl depresses it—evidence that economies of scope are outweighed by coordination and regulatory costs when distance or jurisdiction proliferate.

Result 1 (b): Complexity and Performance: ROE

Panel B: ROE	(1)	(2)	(3)	(4)
$\widehat{\text{Business Complexity}}$	-0.1588***			
	(-9.056)			
$\widehat{\text{Distance Complexity}}$		-0.1861***		
		(-10.642)		
$\widehat{\text{Jurisdictional Complexity}}$			-0.2775***	
			(-23.025)	
$\widehat{\text{Jurisdictional Complexity By Country}}$				-0.2207***
				(-22.850)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	68, 604	68, 604	68, 604	68, 604
R^2	0.0239	0.0249	0.0267	0.0267
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- Leverage amplifies the pattern seen in ROA: product breadth, distance, and legal fragmentation erode shareholder returns.

Result 1 (c): Complexity and Performance: Tobin's Q

Panel C: Tobin's Q	(1)	(2)	(3)	(4)
$\widehat{\text{Business Complexity}}$	-1.1504***			
	(-11.839)			
$\widehat{\text{Distance Complexity}}$		-1.3297***		
		(-16.705)		
$\widehat{\text{Jurisdictional Complexity}}$			-1.9409***	
			(-37.120)	
$\widehat{\text{Jurisdictional Complexity By Country}}$				-1.5459***
				(-37.171)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	68, 604	68, 604	68, 604	68, 604
R^2	0.0817	0.0898	0.1041	0.1043
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- Markets do not reward product breadth, geographic/legal sprawl—investors price growth options positively only when complexity does not impose heavy coordination or agency costs.

Does Complexity Affect Reinsurers Differently than Primary Insurers?

Key Research Questions:

- Is the business model of reinsurers differs from that of primary insurers?
- How does complexity affect reinsurers' market valuation and profitability?

Reinsurance: $\mathbf{1}\{\text{Group is reinsurer}\} = 1$, 0 otherwise.
Regression Model (2SLS):

$$\begin{aligned}\text{Performance}_{i,t} = \beta_0 + \beta_1 \widehat{\text{Complexity}}_{i,t} + \beta_2 \,\text{Reinsurance}_{i,t} \\ + \beta_3 \big(\widehat{\text{Complexity}}_{i,t} \times \text{Reinsurance}_{i,t}\big) + \sum_{\ell=1}^{L} \gamma_\ell \,\text{Controls}_{i,t}^{\ell} + \mu_i + \theta_t + \varepsilon_{i,t}.\end{aligned}$$

Controls:

- **Firm characteristics:** ln(Assets), Cash Flow, Leverage, Number of Employees
- **Macroeconomic factors:** Financial Development Index, Short-Term Interest Rate, Bond Yield, GDP Deflator

Result 2 (a): Complexity, Reinsurance and Performance: ROA

Panel A: ROA	(1)	(2)	(3)	(4)
Reinsurance	-0.0092**	-0.0064**	-0.0076	-0.0106***
	(-2.121)	(-2.181)	(-1.898)	(-2.817)
$\widehat{\text{Complexity}} \times$ Reinsurance	0.0173**	0.0236**	0.0250**	0.0296***
	(2.171)	(2.308)	(2.114)	(3.007)
Business $\widehat{\text{Complexity}}$	-0.0453***			
	(-8.798)			
Distance $\widehat{\text{Complexity}}$		-0.0544***		
		(-10.562)		
Jurisdictional $\widehat{\text{Complexity}}$			-0.0834***	
			(-18.740)	
Jurisdictional $\widehat{\text{Complexity}}$ By Country				-0.0672***
				(-18.307)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	68, 604	68, 604	68, 604	68, 604
R^2	0.0260	0.0272	0.0295	0.0296
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- The negative coefficient on reinsurance suggests a direct reduction in ROA.
- Interactions with jurisdictional complexity indicate potential profitability gains.

Result 2 (b): Complexity, Reinsurance and Performance: ROE

Panel B: ROE	(1)	(2)	(3)	(4)
Reinsurance	-0.0309	-0.0215*	-0.0209	-0.0322**
	(-1.860)	(-1.826)	(-1.332)	(-2.159)
$\widehat{\text{Complexity}} \times$ Reinsurance	0.0589*	0.0803**	0.0716	0.0917**
	(1.938)	(1.990)	(1.548)	(2.372)
Business $\widehat{\text{Complexity}}$	-0.1629***			
	(-9.393)			
Distance $\widehat{\text{Complexity}}$		-0.1925***		
		(-10.917)		
Jurisdictional $\widehat{\text{Complexity}}$			-0.2876***	
			(-18.892)	
Jurisdictional $\widehat{\text{Complexity}}$ By Country				-0.2317***
				(-18.420)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	68, 604	68, 604	68, 604	68, 604
R^2	0.0241	0.0251	0.0269	0.0270
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- The negative coefficient on reinsurance suggests a direct reduction in ROE.
- Interacting reinsurance with jurisdictional complexity can raise shareholder returns.

Result 2 (c): Complexity, Reinsurance and Performance: Tobin's Q

Panel C: Tobin's Q	(1)	(2)	(3)	(4)
Reinsurance	-0.1401***	-0.1136***	-0.1133***	-0.1823***
	(-3.445)	(-3.516)	(-3.741)	(-4.495)
$\widehat{\text{Complexity}} \times$ Reinsurance	0.2744***	0.4334***	0.3980***	0.5244***
	(3.662)	(3.883)	(4.446)	(4.932)
Business $\widehat{\text{Complexity}}$	-1.1719***			
	(-12.346)			
Distance $\widehat{\text{Complexity}}$		-1.3665***		
		(-17.485)		
Jurisdictional $\widehat{\text{Complexity}}$			-2.0002***	
			(-31.394)	
Jurisdictional $\widehat{\text{Complexity}}$ By Country				-1.6108***
				(-29.001)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	68, 604	68, 604	68, 604	68, 604
R^2	0.0825	0.0911	0.1055	0.1061
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- The negative coefficient on reinsurance suggests a direct reduction in Tobin's Q.
- Positive interactions with complexity measures indicate a partial offset of this negative effect.

Data

Does Complexity Lead to Better Performance?

What are the Drivers of Offshore Expansion?

Does Complexity Help to Resolve Protection Gap?

Are the Same Factors Driving Expansion to Advanced and Emerging Markets?

What are the Drivers of Offshore Expansion?

Key Research Questions:

- Does business, jurisdictional, and distance complexity increase offshore usage?
- Do regulatory diversity and strict capital controls incentivize offshore usage?
- Do reinsurers have a high propensity to expand in offshore regions?

Regression Model (2SLS):

$$Y_i = \beta_0 + \beta_1 \widehat{\text{Complexity}}_i + \beta_2 \,\text{Diversity of capital regime}_i + \beta_3 \,\text{Share of high capital control}_i + \beta_4 \,\text{Share of reinsurance}_i + \sum_{\ell=5}^{L} \beta_\ell \,\text{Controls}_i + \varepsilon_i,$$

where $Y_i(t)$ is the share of offshore subsidiaries for group i at time t

Controls:

- **Firm characteristics:** ln(Assets), Cash Flow, Leverage, Number of Employees
- **Macroeconomic factors:** Financial Development Index, Short-Term Interest Rate, Bond Yield, GDP Deflator

Result 3: Complexity and Offshore Expansion

Share of Offshore Subsidiaries	(1)	(2)	(3)	(4)
$\widehat{\text{Business Complexity}}$	-0.1318***			
	(-5.3088)			
$\widehat{\text{Distance Complexity}}$		-0.1351***		
		(-4.3631)		
$\widehat{\text{Jurisdictional Complexity}}$			-0.1716***	
			(-3.9549)	
$\widehat{\text{Jurisdictional Complexity By Country}}$				-0.1364***
				(-3.9517)
Diversity of capital regime	0.0396***	0.0401***	0.0395***	0.0395***
	(7.0976)	(7.3457)	(7.0512)	(7.0513)
Share of high capital control	0.1186***	0.1185***	0.1192***	0.1192***
	(8.3171)	(8.2629)	(8.3178)	(8.3174)
Share of reinsurance	0.4196***	0.4193***	0.4188***	0.4188***
	(12.886)	(13.001)	(13.129)	(13.130)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	2,686,361	2,686,361	2,686,361	2,686,361
R^2	0.126	0.126	0.126	0.126
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- Complexity is a substitute for offshore expansion. Groups expand offshore only if they operate in a regulatory-fragmented market or have high regulatory constraints
- Reinsurers are more likely to establish offshore compared to primary insurers

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What are the Drivers of Offshore Expansion?

Does Complexity Help to Resolve Protection Gap?

Are the Same Factors Driving Expansion to Advanced and Emerging Markets?

Empirical Analysis

- **Corporate-structure dataset**
  - Observational Unit: 100 largest cross-border insurers (by assets)
  - Scope: >8 000 subsidiaries, 117 host countries; HQs in 21 jurisdictions.
  - Sources: S&P Global Market Intelligence, audited annual reports, SEC Form 20-F/40-F.
- **Insurance protection gap & resilience**
  - Source: Swiss Re (2017), for 57 countries.
- **Domestic market & macro controls**
  - Sources: OECD, IMF, World Bank.
- **Temporal scope**: All variables measured for the calendar year 2017 only.
- **Methodological caveat**: Endogeneity is not addressed.

Measures of Protection Gap

Normalized Protection Gap

- Measures the difference between full insurance coverage and actual coverage, normalized by GDP

$$\text{Normalized Protection Gap}_{ij} = \frac{\text{Protection Gap}_{ij}}{\text{GDP}_j} \tag{1}$$

Resilience Index

- Quantifies the coverage ratio of a country. It is an index from 0 to 1

$$\text{Resilience Index}_{ij} = 1 - \left(\frac{\text{Protection Gap}_{ij}}{\text{Risk Exposure}_{ij}} \right) \tag{2}$$

Risk Exposure

- Quantifies the total loss that a country can withstand normalized by GDP

$$\text{Risk Exposure}_{ij} = \frac{\text{Normalized Protection Gap}_{ij}}{1 - \text{Resilience Index}_{ij}} \tag{3}$$

Does Higher Complexity Help to Reduce the Protection Gap?

$$y_g = \beta_0 + \beta_1 \,\text{Business Complexity} + \beta_2 \,\text{Jurisdictional Complexity} + \beta_3 \,\text{Distance Complexity} + \sum_{s=4}^{S} \gamma_s \,\text{Complexity Interaction}_s + \sum_{c=S+1}^{C} \beta_c \,\text{Controls}_c + \varepsilon$$

where y_g represents the normalized protection gap, resilience index, or risk exposure for group g.
Controls:

- **Size Controls:** log(Gross Premiums), log(Number of Subsidiaries).
- **Market Controls:** Market Share, Financial Development Index (FDI), Market Share $\times$ Financial Development Index, Index of Dominance.

Result 4: Protection Gap and Group Complexity

	Normalized Protection Gap	Resilience Index	Risk Exposure
Business Complexity	0.009**	−11.509**	0.019**
	(0.005)	(5.655)	(0.009)
Jurisdictional Complexity	0.006***	−6.902***	0.010***
	(0.002)	(1.751)	(0.003)
Distance Complexity	0.006***	−6.716***	0.009**
	(0.002)	(1.978)	(0.004)
Business Complexity × Jurisdictional Complexity	−0.013***	12.098**	−0.027***
	(0.005)	(5.566)	(0.009)
Business Complexity × Distance Complexity	−0.012**	10.855	−0.021*
	(0.005)	(6.622)	(0.011)
Jurisdictional Complexity × Distance Complexity	−0.008***	2.756	−0.013***
	(0.002)	(2.843)	(0.005)
Business Complexity × Jurisdictional Complexity × Distance Complexity	0.010**	9.927*	0.016
	(0.005)	(6.005)	(0.010)
Market Share	0.559***	−578.886***	1.192***
	(0.048)	(53.562)	(0.101)
Financial Development Index	0.045***	26.483***	0.080***
	(0.003)	(2.984)	(0.006)
Market Share × Financial Development Index	−0.668***	622.133***	−1.367***
	(0.074)	(72.093)	(0.146)
log(Gross Premiums)	−0.001***	−4.732***	−0.002***
	(0.0002)	(0.106)	(0.0003)
log(Number of Subsidiaries)	−0.00004	0.081	−0.0005
	(0.0001)	(0.181)	(0.0003)
Index of Dominance	0.001	−1.063	0.002
	(0.001)	(1.242)	(0.002)
Constant	−0.019***	97.186***	−0.027***
	(0.002)	(2.805)	(0.004)
Observations	79	79	79
R^2	0.204	0.491	0.196
Adjusted R^2	0.202	0.489	0.194

- Groups with higher business complexity, jurisdictional complexity, and distance complexity significantly expand in regions with greater protection gaps and risk exposure

Data

Does Complexity Lead to Better Performance?

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Regression Model (2SLS):

$$Y_i = \beta_0 + \beta_1 \widehat{\text{Complexity}}_i + \beta_2 \,\text{Share of life}_i + \beta_3 \,\text{Share of non-life}_i + \beta_4 \,\text{Share of reinsurance}_i + \sum_{\ell=5}^{L} \beta_\ell \,\text{Controls}_i + \varepsilon_i,$$

where $Y_i(t)$ is the share of subsidiaries in advanced/developing market for group i at time t
Controls:

- **Firm characteristics:** ln(Assets), Cash Flow, Leverage, Number of Employees
- **Macroeconomic factors:** Financial Development Index, Short-Term Interest Rate, Bond Yield, GDP Deflator

Result 5 (a): Expansion Into Advanced Economies

Share of Subsidiaries in Advanced Economies	(1)	(2)	(3)	(4)
$\widehat{\text{Business Complexity}}$	0.2974***			
	(3.2451)			
$\widehat{\text{Distance Complexity}}$		0.2819***		
		(2.8819)		
$\widehat{\text{Jurisdictional Complexity By Region}}$			0.2307**	
			(2.5447)	
$\widehat{\text{Jurisdictional Complexity By Country}}$				0.1828**
				(2.5395)
Share of Life	-0.0449***	-0.0449***	-0.0448***	-0.0448***
	(-5.9605)	(-5.9451)	(-5.9412)	(-5.9407)
Share of Non-Life	0.0383***	0.0378***	0.0378***	0.0378***
	(3.2472)	(3.2327)	(3.2443)	(3.2446)
Share of Reinsurance	-0.4357***	-0.4344***	-0.4342***	-0.4342***
	(-14.788)	(-14.699)	(-14.598)	(-14.599)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	2,686,422	2,686,422	2,686,422	2,686,422
R^2	0.0637	0.0635	0.0628	0.0628
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- Groups with higher organizational complexity are located primarily in developed markets with a significant share of non-life subsidiaries. Reinsurance groups have a lower presence with a focus on offshore markets instead.

Result 5 (b): Expansion Into Developing Economies

Share of Subsidiaries in Developing Economies	(1)	(2)	(3)	(4)
$\widehat{\text{Business Complexity}}$	0.1329***			
	(2.8644)			
$\widehat{\text{Distance Complexity}}$		0.1063***		
		(2.6807)		
$\widehat{\text{Jurisdictional Complexity By Region}}$			0.0524	
			(1.6375)	
$\widehat{\text{Jurisdictional Complexity By Country}}$				0.0428*
				(1.6905)
Share of Life	0.0287***	0.0287***	0.0287***	0.0287***
	(5.2956)	(5.2910)	(5.2758)	(5.2762)
Share of Non-Life	-0.0348***	-0.0350***	-0.0350***	-0.0350***
	(-3.0163)	(-3.0353)	(-3.0313)	(-3.0316)
Share of Reinsurance	0.0063	0.0068	0.0065	0.0065
	(0.9873)	(1.0493)	(1.0202)	(1.0225)
Firm Controls	Yes	Yes	Yes	Yes
Macro Controls	Yes	Yes	Yes	Yes
Observations	2,686,422	2,686,422	2,686,422	2,686,422
R^2	0.0090	0.0088	0.0086	0.0086
Entity FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes

- Business and distance complexity significantly increase entry into developing economies; life business share remains positively associated, while non-life share is negative.

Conclusion

- **Diverse Global Insurance Market**
  Varied regional footprints and business lines reflect the complex structures of global insurance groups.
- **Performance**
  Business, distance, and jurisdictional complexity lower Tobin's Q, ROA, and ROE, indicating the presence of diversification discount.
- **Reinsurance**
  Reinsurance generally reduces valuations and profits, yet it offsets some negative effects for complex insurers in certain risk-transfer interactions.
- **Regulation & Offshoring**
  Stricter regimes, fragmentation, and capital controls raise valuations but impose heavier burdens on highly complex groups. Offshore expansions grow under reinsurance, tax, and regulatory arbitrage motives.

Reflection: Overall, these findings show that complexity enables expansions into emerging markets but still does not ensure higher valuations—reinsurance interactions, regulatory burdens, and market factors remain decisive