



Insurance Risk Study

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Insurance Risk Study

- Systemic volatility
- Correlations
- By class, by country
- 46 countries
- Over 90% of global premium
- Fifth edition released last September



A photograph of a white sailboat on a blue body of water under a clear sky. The boat's mast and rigging are visible in the foreground. In the background, there are green hills. The text 'Systemic Risk' is overlaid in white on the left side of the image.

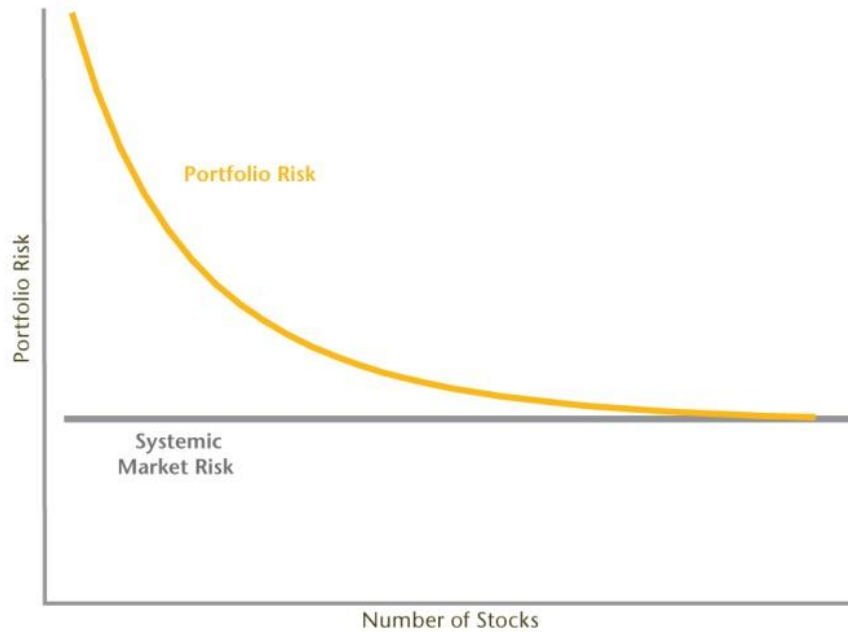
Systemic Risk

Volatility is important for quantifying impact on:

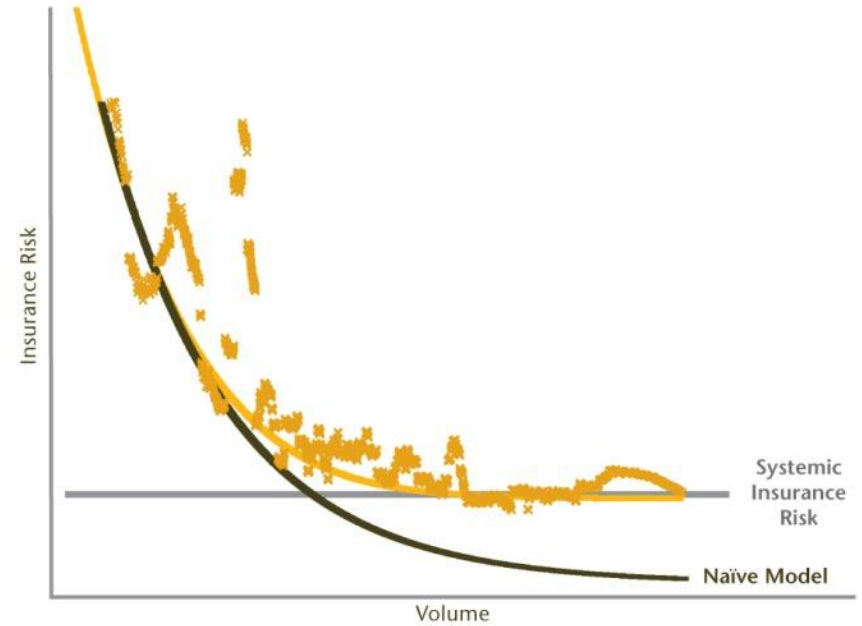
- Pricing / Reserving
- Capital Adequacy / Solvency

Systemic Risk

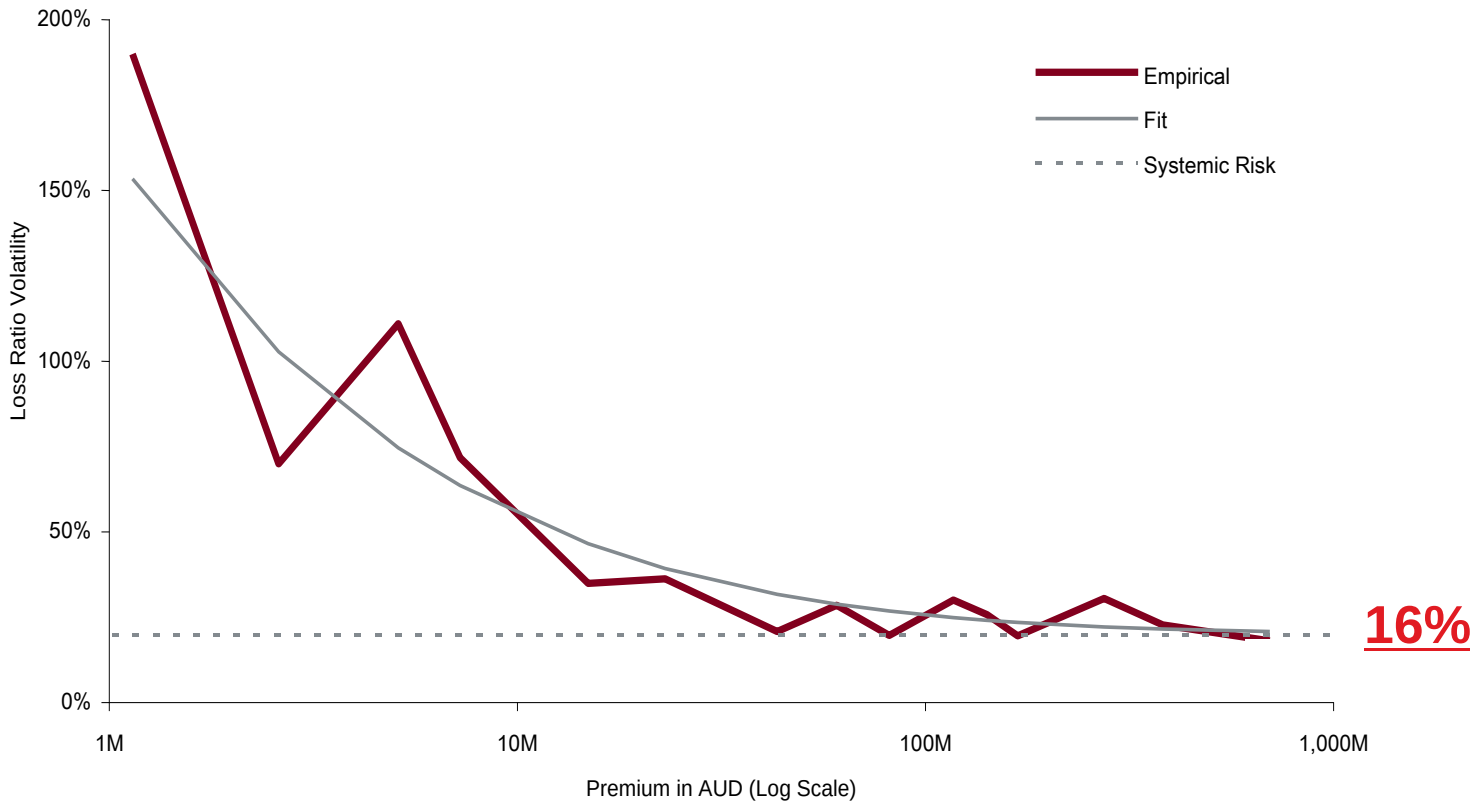
Asset Portfolio Risk



Insurance Portfolio Risk



Systemic Risk – Australia Property



There is a strong pattern of decreasing volatility with increasing size for every line, everywhere

Systemic Risk

Systemic risk stems from non-diversifiable risk sources such as:

- Pricing cycle
- Natural disasters
- Legal reforms and court decisions
- Level of economic activity
- Unknown prospective frequency and severity trends

Volatility by Line by Country

	Motor	Property	General Liability	Accident & Health	Marine, Aviation & Transit	Workers Compensation
Asia Pacific						
Australia	8%	16%	54%		10%	30%
China	11%	27%	31%	19%	16%	
Hong Kong	43%	67%	82%	24%	60%	81%
India	12%	31%		14%	31%	
Indonesia	29%	58%	124%	56%	72%	
Japan	5%	28%	10%	8%	17%	7%
Malaysia	15%	28%	126%	30%	40%	88%
Singapore	27%	71%		52%	57%	46%
South Korea	7%	42%	32%		55%	
Taiwan	7%	98%	53%	33%	71%	
Vietnam	18%	38%	41%	11%	38%	

Insurance Correlation



Stress Test Correlation Example

UW Result Statistics (\$m)		Correlated - Same Correlation Matrix			
	Independent	Normal	t, 8 dof	t, 2 dof	Dependent
Mean Loss	937	937	937	937	937
Std. Dev.	134	175	185	182	289

UW Percentile Combined Ratios		Normal	t, 8 dof	t, 2 dof	Dependent
	Independent				
0.20%	150%	166%	173%	186%	211%
0.40%	125%	135%	140%	151%	170%
0.50%	119%	132%	136%	145%	164%
1.00%	115%	126%	126%	132%	150%
10.00%	104%	109%	108%	107%	118%
20.00%	100%	103%	103%	102%	108%
30.00%	98%	100%	99%	98%	101%
50.00%	94%	94%	94%	94%	92%
70.00%	91%	89%	89%	89%	84%
90.00%	87%	82%	83%	84%	75%

Correlation Between Lines - China

China	Accident & Health	Agriculture	Credit	Engineering	General Liability	Marine, Aviation & Transit	Motor	Property
Accident & Health		24%	31%	39%	53%	38%	59%	56%
Agriculture	24%		53%	n/a	29%	9%	16%	-4%
Credit	31%	53%		n/a	18%	18%	34%	25%
Engineering	39%	n/a	n/a		68%	38%	64%	28%
General Liability	53%	29%	18%	68%		29%	62%	54%
Marine, Aviation & Transit	38%	9%	18%	38%	29%		41%	24%
Motor	59%	16%	34%	64%	62%	41%		59%
Property	56%	-4%	25%	28%	54%	24%	59%	

The correlations shown in **bold** are statistically different from zero at the 90% confidence level

Correlation Between Lines - Japan

Japan	Accident & Health	General Liability	Marine, Aviation & Transit	Motor	Property	Workers Comp
Accident & Health		27%	1%	50%	42%	53%
General Liability	27%		0%	3%	32%	28%
Marine, Aviation & Transit	1%	0%		16%	33%	-4%
Motor	50%	3%	16%		61%	43%
Property	42%	32%	33%	61%		32%
Workers Comp	53%	28%	-4%	43%	32%	

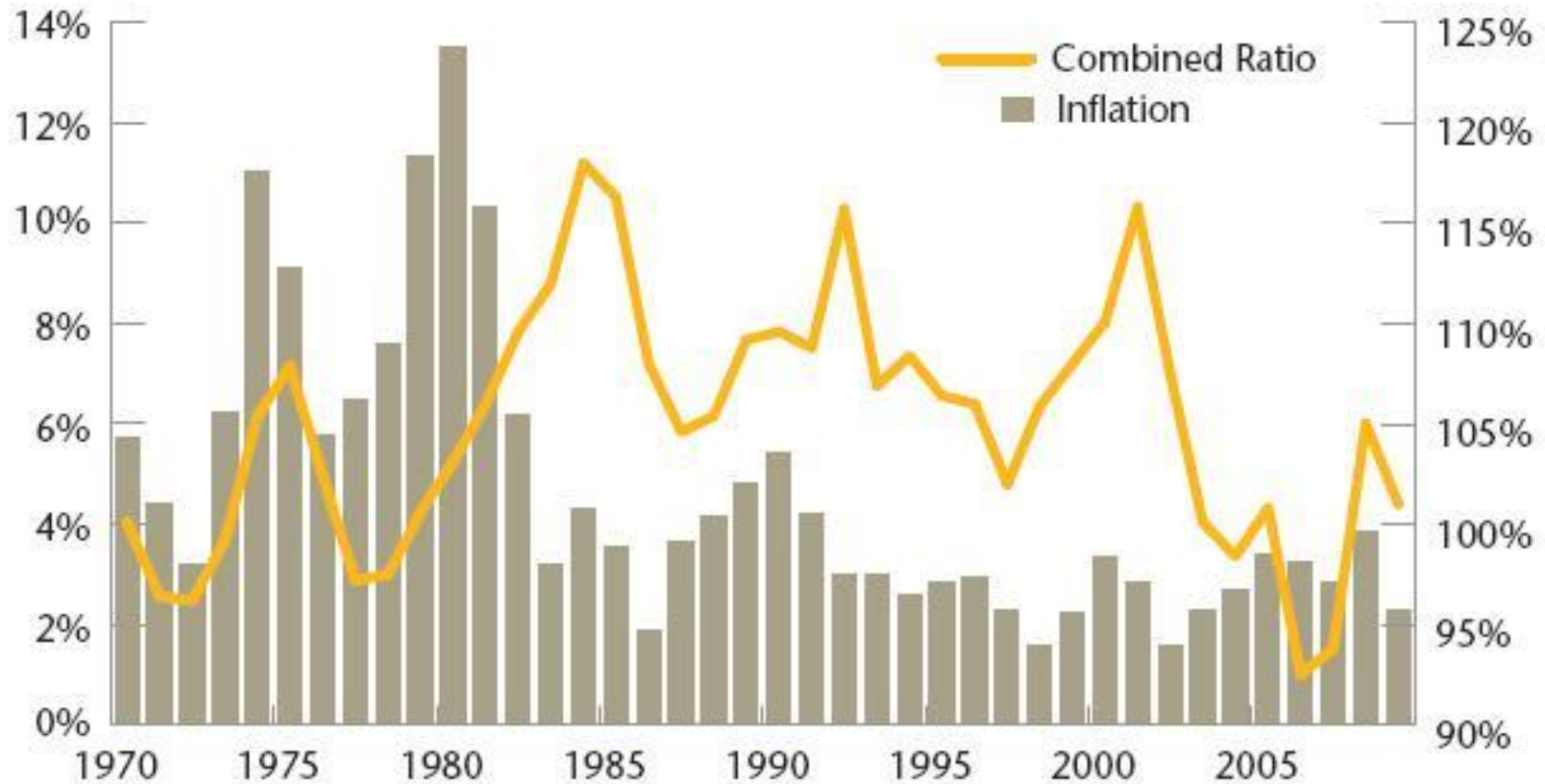
Correlation Between Lines – Other Countries

									...	Accident & Health	Commercial Lines Liability	Commercial Motor	Commercial Property	Financial Loss	Household & Domestic	Private Motor
									Accident & Health		47%	n/a	55%	-49%	15%	55%
									Commercial Lines Liability	47%		72%	40%	69%	49%	56%
Japan									Accident & Health	General Liability	Marine, Aviation & Transit	Motor	Property	Workers Comp		
										27%	1%	50%	42%	53%	-9%	61%
											0%	3%	32%	28%	33%	39%
									Accident & Health						16%	-15%
									General Liability	27%					30%	30%
China									Accident & Health	Agriculture	Credit	Engineering	General Liability	Marine, Aviation & Transit	Motor	Property
									Accident & Health							
										24%	31%	39%	53%	38%	59%	56%
									Agriculture		53%	n/a	29%	9%	16%	-4%
									Credit			n/a	18%	18%	34%	25%
									Engineering	39%	n/a		68%	38%	64%	28%
									General Liability	53%	29%	18%	68%	29%	62%	54%
									Marine, Aviation & Transit	38%	9%	18%	38%	29%	41%	24%
									Motor	59%	16%	34%	64%	41%		59%
									Property	56%	-4%	25%	28%	54%	24%	

Inflation



Inflation and Combined Ratio (US Data)



A photograph of a sailboat on a blue body of water under a clear sky. The boat's white hull and rigging are visible in the foreground. The word "Assets" is written in white text in the upper left corner.

Assets

“Constructed by a nerdy-sounding priesthood using esoteric terms such as beta, gamma, sigma and the like, these models tend to look impressive. Too often, though, investors forget to examine the assumptions behind the symbols. Our advice: Beware of geeks bearing formulas.”

Warren Buffett, 2008 Berkshire Hathaway Letter to the Shareholders

Macroeconomic Correlations

	Inflation (CPI-U)	Inflation (PPI)	GDP Growth	Unemployment Change	3-Month T-Bill Rate	1-3 Year T-Bill	AAA-AA 3-5 Year Spread	BBB 3-5 Year Spread	S&P 500 Returns	VIX	Property Returns
Inflation (CPI-U)		78%	-3%	-2%	32%	26%	-11%	-25%	-12%	-23%	13%
Inflation (PPI)	78%		4%	-7%	30%	11%	-4%	-20%	-7%	-22%	14%
GDP Growth	-3%	4%		-70%	-4%	25%	-64%	-69%	5%	-44%	52%
Unemployment Change	-2%	-7%	-70%		-3%	-27%	62%	77%	-1%	57%	-51%
3-Month T-Bill Rate	32%	30%	-4%	-3%		98%	-34%	-58%	-6%	-25%	13%
1-3 Year T-Bill	26%	11%	25%	-27%	98%		-39%	-61%	19%	-28%	10%
AAA-AA 3-5 Year Spread	-11%	-4%	-64%	62%	-34%	-39%		85%	-43%	62%	-66%
BBB 3-5 Year Spread	-25%	-20%	-69%	77%	-58%	-61%	85%		-36%	67%	-53%
S&P 500 Returns	-12%	-7%	5%	-1%	-6%	19%	-43%	-36%		-51%	17%
Stock Volatility Index, VIX	-23%	-22%	-44%	57%	-25%	-28%	62%	67%	-51%		-32%
Property Returns	13%	14%	52%	-51%	13%	10%	-66%	-53%	17%	-32%	

Equity Market Correlation

MARKET	U.S.	EURO	U.K.	JAPAN
U.S.	100%	53%	49%	11%
Euro	53%	100%	88%	28%
U.K.	49%	88%	100%	32%
Japan	11%	28%	32%	100%

Equity Model Performance in 2008

MARKET	U.S.	EURO	U.K.	JAPAN
Index	S&P 500	EURO STOXX	FTSE All-share	TOPIX 1000
Index at August 29, 2008	1283	318	2869	1200
Index at March 9, 2009	677	169	1792	674
Capital Return	-47%	-47%	-38%	-44%
Lognormal Return Period	239,000	6,500	13,500	1,000

- Standard equity models did not perform well during the market decline. The return periods assigned to observed declines are in excess of 1 in 1,000 years
- A solution: a stochastic volatility model such as a Heston model

Benefits



Benefits

- Risk parameterisation
- Volatility
- Reserving
- Capital modelling
- Benchmarking
- Correlation
- Pricing
- Assets



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Reference

Insurance Risk Study (2010)

http://www.aon.com/attachments/reinsurance/201009_ab_insurance_risk_study_sept_2010.pdf