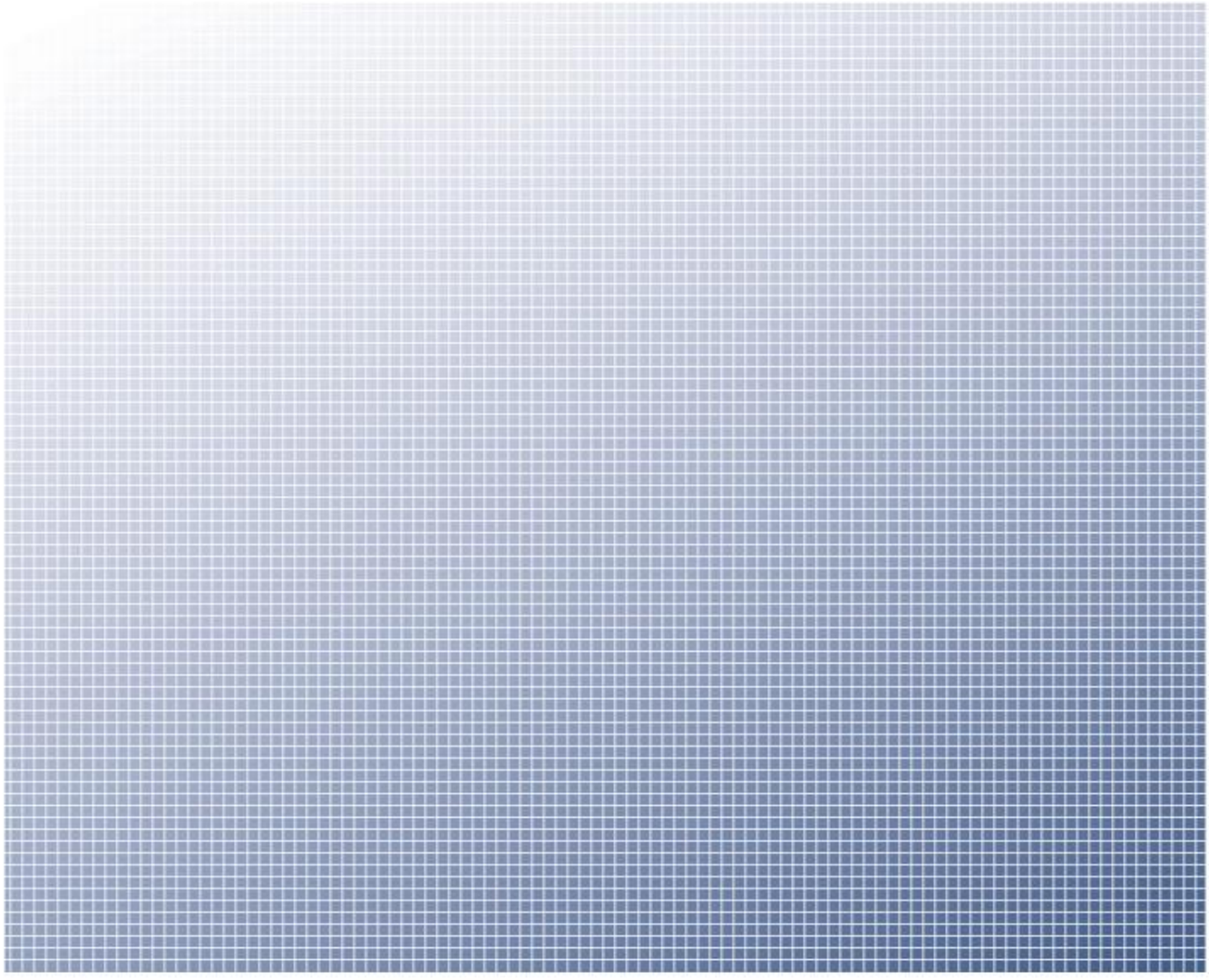
December 2025

Bermuda Monetary Authority

Bermuda Insurance Property and Casualty Market

Catastrophe Risk and Stress Testing Analysis

Report on 2024 Financial Year Data



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Acronyms

AAL	Average Annual Loss
A&E	Asbestos and Environmental
Authority	Bermuda Monetary Authority
BMA	Bermuda Monetary Authority
C&S	Capital and Surplus
Cat	Catastrophe
Cat Return	Catastrophe Risk Return and Schedule of Risk Management
CSR	Capital and Solvency Return
CPR	Constant Prepayment Rate
EP	Exceedance Probability
MBS	Mortgage-backed Security
PML	Probable Maximum Loss
RDS	Realistic Disaster Scenarios
SPI	Special Purpose Insurer
TVaR	Tail Value at Risk

Foreword

In 2024, Bermuda's international (re)insurance sector maintained a strong combined ratio and solid net income, supported primarily by a stable pricing environment. While terms and conditions only selectively loosened, limit and aggregation management remained disciplined, and investment returns were favourable.

However, uncertainty persists in the global economic landscape. Geopolitical tensions, including potential trade disputes alongside the potential impact of further interest rate cuts (particularly in the US), and the unclear trajectory of headline inflation, continue to pose challenges. Claims inflation remains under pressure, exacerbated by upward trends in social inflation across certain lines. Although recession fears in major economies have eased, global and local growth appear to be stagnating, requiring insurers to navigate a complex and evolving risk environment.

In Bermuda, predominantly a reinsurance market, (re)insurers achieved strong profitability in 2024. This was supported by catastrophe losses that remained within expected and priced-in ranges, despite a global increase in total estimated losses projected to exceed US$130 billion. The precise impact of climate change on the frequency and severity of catastrophic events remains uncertain. However, data increasingly point to secondary perils such as convective storms, floods, and wildfires, including recent events in California, as key drivers of catastrophe losses. Bermuda (re)insurers benefitted from risk-adequate pricing, prudent retentions, restricted coverage and well-structured programmes aligned with their risk appetite.

The Bermuda Monetary Authority (Authority or BMA) continually monitors trends and market developments, including evolving risks and business models. As part of its macroprudential mandate and given the Bermuda market's relatively high concentration of Catastrophe (Cat) risk, the Authority prioritises maintaining a broad understanding of Bermuda insurers' Cat exposure, including the stress testing analysis and monitoring concentration of risk in Bermuda.

The assessment of Cat risk exposure and stress testing at the micro and macro levels are fundamental elements of the Authority's overall supervisory framework. These elements allow the Authority to evaluate insurers' capital adequacy under adverse financial markets and underwriting conditions. The results of the assessment provide a comprehensive understanding

of the sector's general vulnerability to shocks. As shown in this report, Bermuda insurers remain well capitalised to absorb any unlikely and potentially significant losses.

Ricardo Garcia
Managing Director, Supervision

Bermuda Insurance Market Stress Testing Report

This is the Authority's sixth standalone annual *Catastrophe Risk and Stress Testing Analysis Report* and is the result of an analysis conducted by BMA staff.

About the BMA

The BMA was established by statute in 1969. Its role has evolved over the years to meet the changing needs of Bermuda's financial services sector. Today, the Authority supervises, regulates and inspects financial institutions operating in the jurisdiction. It also issues Bermuda's national currency, manages exchange control transactions, assists other authorities with detecting and preventing financial crime and advises the Government on banking and other financial and monetary matters.

The Authority develops risk-based financial regulations that apply to the supervision of Bermuda's banks, trust companies, investment businesses, investment funds, fund administrators, money service businesses, corporate service providers, insurance companies, digital asset businesses and digital asset issuances. It also regulates the Bermuda Stock Exchange and the Bermuda Credit Union.

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1. Executive Summary

The 2024 Cat Risk Return and Schedule of Risk Management (together 'Cat Return') results show that the gross loss exposure assumed by Bermuda insurers increased by 7.5%, from US$204.51 billion in 2023 to US$219.87 billion in 2024. Furthermore, the value of global gross estimated potential loss assumed by Bermuda insurers from the major Cat perils (combined) has increased from US$184.75 billion in 2023 to US$197.99 billion in 2024; the Bermuda market increased marginally to 24% as a proportion of the industry losses as defined by the Lloyd's Realistic Disaster Scenario Specification Year-over-Year (YoY).[1] After a hardening of the market in 2022 and 2023, the Cat exposure assumed by the Bermuda market grew commensurately with the size of the Lloyd's Realistic Disaster Scenarios (RDS) industry losses.

An analysis of the Exceedance Probability (EP) curves demonstrates that Bermuda insurers are more exposed to the Atlantic Hurricane peril than any other peril, with gross average modelled losses across all companies ranging from US$1,086.3 million for 1-in-50-year events, up to US$2,060.6 million for 1-in-1,000-year events. Other perils show lower modelled losses for the 1-in-50 and 1-in-1,000-year events, with some variation between firms. The use of reinsurance is widespread and is generally more pronounced for lower frequency return periods for the Atlantic Hurricane and North American Earthquake perils.

The 2024 financial year stress test results demonstrated that the Bermuda insurance market is resilient to potential adverse impacts, including the financial market, catastrophe and other underwriting loss scenarios. The results highlight the industry's overall resilience and establish Bermuda insurers' ability to absorb losses from low frequency, high severity events while still having capital remaining to settle policyholder obligations and meet regulatory capital requirements.

[1] Insurers are required to run the Lloyd's-developed Realistic Disaster Scenarios (RDS) as specified in Lloyd's Handbook on *Realistic Disaster Scenarios – Scenario Specification January 2025*. In doing this, they should use aggregates in force on 1 January 2025.

Table 1.1 – Key Findings

Description	*US$ or per cent*	*Notes*
Gross loss exposure	$219.87 billion	7.5% increase YoY
Ceded loss	$124.83 billion	5.36% increase YoY
Net loss exposure	$95.04 billion	10.45% increase YoY
Global share of gross estimated exposure on the major Cat perils	$197.99 billion	24% of global share
Total pre-stress capital and surplus	$160.63 billion	Participating insurers only
Total post Cat-stress (aggregate of Largest Three Cat Scenarios) capital and surplus - net	$117.42 billion	Participating insurers only
Average capital and surplus post aggregate of Three Largest Cat Underwriting Scenarios - net	70.81%	1.24% increase YoY
Average capital and surplus post 'Other Underwriting Loss' Scenarios	88.51%	-4.48% decrease YoY
Average capital and surplus post 'Insurer's Own Worst Case' Scenario	64%	-5.93% decrease YoY
Average capital and surplus post aggregate of 'Largest Three Terrorism Stress' Scenarios	81.38% / 89.89%	Gross and net respectively
Average capital and surplus post 'Cyber Stress' Scenario	91.04% / 93.2%	Gross and net respectively
Average capital and surplus post 'Mortage Insurance Loss' Scenario	88.26% / 94.65%	Shock 1 and 2 respectively
Average capital and surplus post 'New Latent Liability' Scenario	95.54%	2.09% increase YoY
Average capital and surplus post 'Deterioration in Existing US A&E and UK Asbestos' Scenario	97.11%	0.95% increase YoY
Average capital and surplus post a combination of four Financial Market Scenarios	79.3%	Most severe scenerio
Average ceded exposure	57%	-1.16% decrease YoY

Source: BMA staff calculations

2. Introduction

Bermuda's insurance sector is regulated and supervised by the BMA. As part of its regulatory and supervisory measures, the Authority requires all Class 3B and Class 4 insurers to submit a Capital and Solvency Return (CSR), which includes a Cat Return detailing the insurers' Cat risk management practices.[2]

Within the Cat Return, insurers report their Cat exposures, their EP curves (for various return periods), their Average Annual Losses (AAL) and their Probable Maximum Losses (PML). In addition, insurers are required to conduct rigorous forward-looking stress tests to assess the sensitivity of their statutory capital and surplus to adverse financial market conditions and underwriting conditions. The Cat Return also serves as a point of reference in the prudential filings for the quantification of Cat risk assumed in Bermuda.

Drawing from the information in the Cat Returns, this report gives an overview of the Cat risk exposure assumed by Bermuda's insurance sector. It also assesses the sector's capacity to absorb shocks from various adverse financial market and underwriting conditions. The report analyses whether Bermuda insurers are adequately capitalised to withstand severe but plausible losses resulting from a number of events that could adversely affect their economic balance sheets (i.e., economic assets, economic liabilities, and capital and surplus). This report also reviews Bermuda insurers' reliance on reinsurance, including the identification of risk concentrations.

Stress testing is a critical supervisory tool for the BMA, offering a forward-looking view of the resilience of individual insurers and the financial sector as a whole. It helps quantify the financial impact of tail events that exceed standard confidence levels. The results of stress and scenario testing enable the Authority to identify risk concentrations, detect emerging vulnerabilities and assess insurers' response to these challenges.

The BMA does not use the stress testing exercise to determine required capital levels. Nonetheless, the results help the Authority to assess whether the risk assumed by Bermuda insurers is commensurate with each insurer's risk appetite. This information ultimately informs

[2] For the purpose of this report, the term 'insurers' also includes reinsurers.

the Authority's risk-based supervisory approach to address any capital adequacy concerns that are identified during this exercise as part of the Authority's regular supervisory routine.

Information Box

Class 3B and Class 4 insurers are the largest property and casualty commercial insurers in Bermuda's market and are required to maintain statutory capital and surplus of at least 99% TVaR over a one-year time horizon.

Aggregate Statistics for Classes 3B and 4, 2024 (in US$ billions)

Net Written Premiums	72.6
Net Earned Premiums	70.7
Net Income	30.9
Total Claims	39.4
Total Assets	338.0

Source: **BMA staff calculations**

3. Methodology

The report was produced using aggregated and non-aggregated data from the Bermuda CSR filings of Class 3B and Class 4 legal entities for the 12-month period ending 31 December 2024.[3] Specifically, the following schedules from the CSR were used as data sources:

- Schedule V(e) – Schedule of Risk Management: Stress/Scenario Test
- Schedule X(a) – Catastrophe Risk Return: EP Curve Total
- Schedule X(c) – Catastrophe Risk Return: EP Curve for Regions-Perils
- Schedule X(e) – Catastrophe Risk Return: Accumulations Overview
- Schedule X(g) – Catastrophe Risk Return: Reinsurance Disclosures

The BMA only aggregated data when doing so produced accurate results. For example, the Authority did not use aggregated EP curve data as the data represent upper quantiles of distributions, and quantiles are not additive functions. On the other hand, the Authority did use aggregated AAL data as AALs represent averages over distributions and can be aggregated without logical inconsistencies. When data could not be aggregated, an augmented boxplot, presenting percentiles and averages, was used to describe the distribution of the variable within the industry. In doing this, care was taken not to identify individual insurers to preserve the confidentiality of the CSR filings.

The exclusion of all other classes, such as Special Purpose Insurers (SPI), limits the conclusions that could be drawn from the results of this survey. Therefore, the results should be viewed as reflecting a segment of the industry and not the exposure of the entire Bermuda insurance market, as it is larger than what is presented in this report.[4] It should also be noted that the report does not consider mortality Cat risk because it excluded long-term (life) insurers.

The stress/scenario impact and effects reported here are those that were observed immediately upon the occurrence of the event (stress/scenario) as determined by the insurer's internal or vendor model(s), both with and without the effects of reinsurance and/or other loss mitigation

[3] Not all insurers have 31 December year-ends. Therefore, the data used in the report may not fully reconcile with other BMA reports that may include fall-end underwriting data.
[4] The Bermuda insurance market includes the Bermuda reinsurance market and SPIs.

instruments. The stress/scenarios were run against the insurers' balance sheet positions and aggregated in-force exposures as of 1 January 2025[5].

To assist the BMA with comparability, insurers were required to provide a description of the vendor model(s) used to perform the stress/scenario tests, including the model and the version used for each stress/scenario. The acquisition of a vendor package is not an obligation and insurers sometimes use internal models. Where an internal model was utilised, the insurer was required to include information on the internal model's key assumptions and parameters.

The analysis in this report was based only on the original CSR data input. No reference was made to the other supporting documents that are required separately as part of the CSR filing. These additional documents were also reviewed by the Authority's supervisory team at the micro level for individual insurers. As such, this report does not reflect subtle nuances provided by an insurer's full return that might otherwise impact these results.

Bermuda Stress Testing Guidelines

This report provides only an overview of insurers' stress/scenario analyses. Each year, the BMA publishes a detailed description along with guidelines for each analysis, including any assumptions made. Complete details and guidelines can be found on the BMA's website in the publication entitled, "2024 Capital and Solvency Return: stress/scenario analysis Class 4, Class 3B and Insurance Groups".

[5] Where the fiscal year does not correspond to the calendar year, in-force exposures on the day following the fiscal year-end were used rather than 1 January 2025.

4. Bermuda's Cat Risk Exposure

For 2024, the YoY gross loss exposure assumed by Bermuda insurers increased 7.52%, from US$204.46 billion in 2023 to US$219.84 billion in 2024. The amount of ceded loss also increased by 5.36%, from US$118.47 billion in 2023 to US$124.83 billion in 2024. The estimated net loss impact to Bermuda insurers increased by 10.49%, from US$85.99 billion in 2023 to US$95.01 billion in 2024. These results are detailed in Table 4.1 below. With a gross loss impact of US$31.10 billion and a net loss impact of almost US$12.43 billion, the Gulf Windstorm peril had the highest gross loss exposure and second highest net loss exposure, followed by the Northeast Hurricane peril (US$28.34 billion gross and US$13.21 billion net) and the San Francisco Earthquake peril (US$25.56 billion gross and US$10.48 billion net).

Table 4.1 - Cat Risk Exposure – Impact of Named Perils (in US$)

Standardised Cat Peril	Gross Loss Impact	Ceded Loss Impact	Net Loss Impact	Gross Loss Impact Ceded (in per cent)
Gulf Windstorm (Onshore)	31,105,315,269	18,678,756,456	12,426,558,813	60
Northeast Hurricane	28,342,702,948	15,132,486,595	13,210,216,353	53
San Francisco Earthquake	25,561,797,604	15,076,987,230	10,484,810,374	59
Pinellas Hurricane	23,357,901,921	14,627,604,254	8,730,297,668	63
Miami-Dade Hurricane	22,201,570,900	14,167,134,832	8,034,436,069	64
Los Angeles Earthquake	20,720,860,812	11,180,649,355	9,540,211,457	54
Carolinas Hurricane	15,419,638,115	9,136,276,403	6,283,361,712	59
European Windstorm	13,257,748,030	6,819,053,825	6,438,694,204	51
Japanese Earthquake	9,591,516,123	4,386,437,700	5,205,078,424	46
Aviation Collision	6,674,601,564	4,119,849,649	2,554,751,915	62
New Madrid Earthquake	4,795,036,330	1,890,204,732	2,904,831,598	39
Major Cruise Vessel Incident	3,861,183,135	2,468,529,497	1,392,653,638	64
US Oil Spill	3,722,610,775	2,281,478,377	1,441,132,398	61
Japanese Typhoon	3,634,023,562	1,467,423,543	2,166,600,019	40
Marine Collision in Prince William	3,432,829,584	2,164,494,787	1,268,334,797	63
US Tornadoes	1,600,196,984	434,232,060	1,165,964,924	27
Australian Flooding	1,587,361,822	426,154,705	1,161,207,117	27
Australian Wildfires	973,335,949	373,204,794	600,131,155	38
Total	**219,840,231,427**	**124,830,958,793**	**95,009,272,634**	**57**

Source: BMA staff calculations.

Using the Lloyd's-developed Realistic Disaster Scenarios' (RDS) ultimate industry settlement estimated values (US$824.69 billion as shown in Table 4.2), the proportion of gross estimated potential loss of these events by Bermuda insurers from the major Cat perils (combined) increased by about 1% YoY.[6] The estimated total industry losses by event, as specified in the RDS event description, also increased YoY. When the European Windstorm

[6] Insurers are required to run the Lloyd's-developed RDS as specified in Lloyd's Handbook on *Realistic Disaster Scenarios – Scenario Specification 2024*. In doing this, they should use aggregates in force on 1 January 2025.

Source: BMA

and the Japanese Typhoon and Earthquake losses are converted to US dollars, they decrease compared to 2023. The Bermuda share decreases commensurately as a result of the US dollar strengthening against the Japanese Yen. The total industry loss for these events is estimated in local currencies and converted to US dollars[7] in Table 4.2.

Table 4.2 - Bermuda Loss to Industry Loss Using Lloyd's Developed RDS (in US$)

Standardised Cat Peril	Estimated Total Industry Loss	Estimated Bermuda Share (gross)	Bermuda Share (in per cent)
Gulf Windstorm (Onshore)	113,000,000,000	31,105,315,269	28
Northeast Hurricane	84,000,000,000	28,342,702,948	34
San Francisco Earthquake	90,000,000,000	25,561,797,604	28
Pinellas Hurricane	137,000,000,000	23,357,901,921	17
Los Angeles Earthquake	88,000,000,000	20,720,860,812	24
Miami-Dade Hurricane	134,000,000,000	22,201,570,900	17
Carolinas Hurricane	40,000,000,000	15,419,638,115	39
Japanese Earthquake	52,480,000,000	9,591,516,123	18
European Windstorm	26,015,000,000	13,257,748,030	51
New Madrid Earthquake	49,000,000,000	4,795,036,330	10
Japanese Typhoon	11,200,000,000	3,634,023,562	32
Total	**824,695,000,000**	**197,988,111,615**	**24**

Source: BMA staff calculations.

Bermuda insurers' share of global catastrophe exposure, as approximated by Lloyd's RDS events, remained broadly stable YoY. This marks the second consecutive year of a modest increase, following a period of reinsurance market hardening that prompted primary insurers to raise retentions, tighten coverage and restructure programmes to manage reinsurance premium budgets.

[7] For this report, *Yahoo Finance* foreign currency exchange rates as of 31 December 2024 were used to convert the non-US$ values into US$ values.

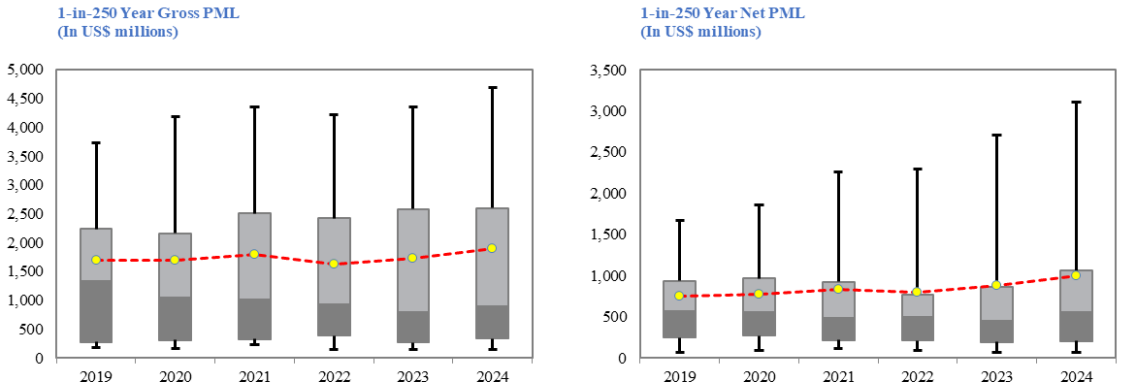
5. Exceedance Probability (EP) Curves

This section provides aggregated outputs from Bermuda catastrophe models. Insurers were required to generate EP curves for the following named perils: Atlantic Hurricane, North American Earthquake, European Windstorm, Japanese Earthquake and Japanese Typhoon.

Data was compiled from EP curves by drawing their distribution from a cross-section of firms for named perils and return periods. EP curves reflect each firm's unique risk profile and modelling practices, and they cannot be aggregated across companies. To provide meaningful insights, the Authority uses summary statistics and boxplots to illustrate the distribution of losses for the combined peril return period. The exhibits include the mean, median, and the 10th, 25th, 75th, and 90th percentiles of the EP curves.

Historical trends for gross and net 1-in-250-year Probable Maximum Loss (PML) for aggregate exposures over the past five years were also analysed. For the BMA's purposes, the 1-in-250-year event represents the most extreme risk to which an insurer can be exposed. The following panel presents the distribution of PML for this return period.

Panel 5.1 - Gross and Net 1-in-250 PML



Source: BMA staff calculations.

Note: Boxplots include the mean (yellow dot), the 25th and 75th percentiles (grey box, with the change of shade indicating the median) and the 10th and 90th percentiles (whiskers).

Insurers increased their average gross 1-in-250-year exposure by 9.66% between 2023 and 2024.[8] The variation within the sample in 2024 increased for gross exposures, with some insurers seeing material changes to their exposures and others maintaining level PMLs. The 90th percentile gross 1-in-250-year exposure was $4.69 billion, with a similar increase to the mean of 7.79% compared to 2023.

Average net 1-in-250-year exposure increased by 13.95% between 2023 and 2024; similarly, the variation in exposures within samples increased. The 90th percentile 1-in-250-year net exposure reached US$3.11 billion.

The largest exposure for Bermuda insurers is the Atlantic Hurricane peril, with the average gross exposure ranging from US$1,086.3 million for a 1-in-50-year event up to US$2,060.6 million for a 1-in-1,000-year event. This is an average figure with variation across firms. For example, at the 90th percentile for the distribution of 1-in-50-year gross PMLs, insurers indicate exposures of US$2,787.9 million and US$1,575.2 million on a net PML basis.

The BMA's net-to-gross exposure ratios are presented in Table 5.1 with corresponding descriptive statistics.

Table 5.1 – Net-to-Gross Exposure for Atlantic Hurricane (in per cent)

Return Period	1-in-50	1-in-100	1-in-250	1-in-500	1-in-1000
Mean	52.9	54.0	56.1	57.9	59.7
Median	48.6	49.6	50.0	50.6	54.3

Source: BMA staff calculations.

Table 5.1 shows that insurers are retaining higher levels of exposure for the most extreme events, with the retained exposure ratio increasing with return periods. The median insurer retains 48.6% of the gross exposure for 1-in-50-year events, while the median insurer retains 54.3% of the gross exposure for 1-in-1,000-year events. Average exposure per peril is also shown by return period, both gross and net, in Tables 5.2 and 5.3.

[8] PMLs for an insurer change for a variety of reasons, including, but not limited to, increasing/decreasing exposure, modelling methodology changes and manual adjustments to modelling outputs, such as applying loading factors or scaling up for un-modelled or under-modelled risks.

Table 5.2 - Average Gross Exposure (in US$ millions)

Return Period	1-in-50	1-in-100	1-in-250	1-in-500	1-in-1000
Atlantic Hurricane	1,086.3	1,316.6	1,613.1	1,833.0	2,060.6
NA. Earthquake	623.7	842.0	1,114.7	1,299.4	1,463.3
European Windstorm	324.9	416.9	522.8	589.4	651.3
Japanese Earthquake	147.4	207.1	272.9	308.7	336.1
Japanese Typhoon	160.8	195.7	228.2	252.4	278.5

Source: BMA staff calculations.

Table 5.3 - Average Net Exposure (in US$ millions)

Return Period	1-in-50	1-in-100	1-in-250	1-in-500	1-in-1000
Atlantic Hurricane	476.4	601.3	791.2	951.9	1,128.5
NA. Earthquake	273.0	363.6	504.9	623.7	741.8
European Windstorm	162.0	204.5	257.5	293.7	330.3
Japanese Earthquake	85.1	115.1	149.2	167.4	182.4
Japanese Typhoon	88.5	105.1	122.1	135.2	149.2

Source: BMA staff calculations.

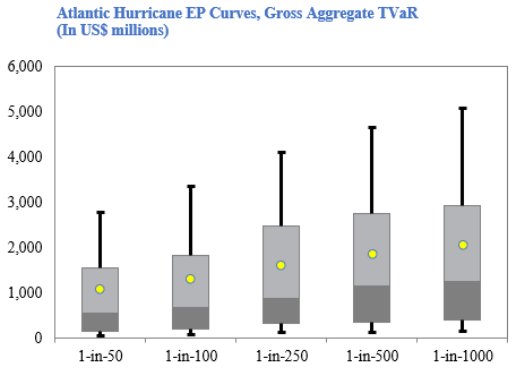
The largest exposure across all return periods is the Atlantic Hurricane peril, followed by the North American (NA) Earthquake peril. The aggregate gross and net EP curves are also plotted by the return period in Panel 5.4, approximating all Cat risk within an insurer's portfolio.

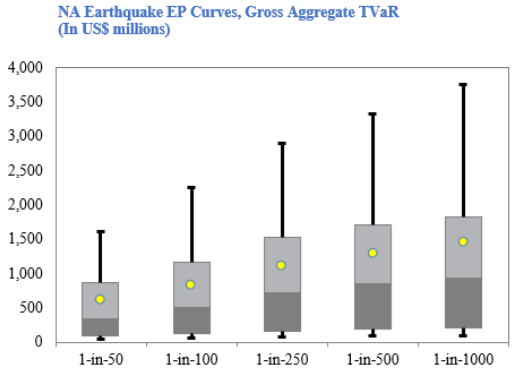
Table 5.4 - Average Exposure for All Perils (in US$ millions)

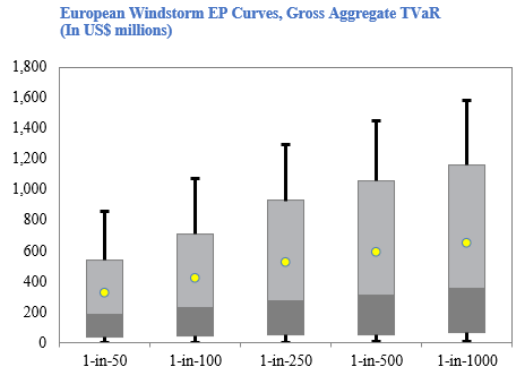
Return Period	1-in-50	1-in-100	1-in-250	1-in-500	1-in-1,000
Gross	1,383.1	1,610.0	1,902.1	2,130.7	2,377.8
Net	668.7	791.9	1,001.3	1,176.9	1,378.1

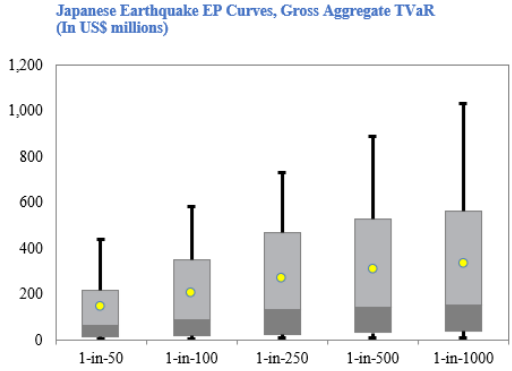
Source: BMA staff calculations.

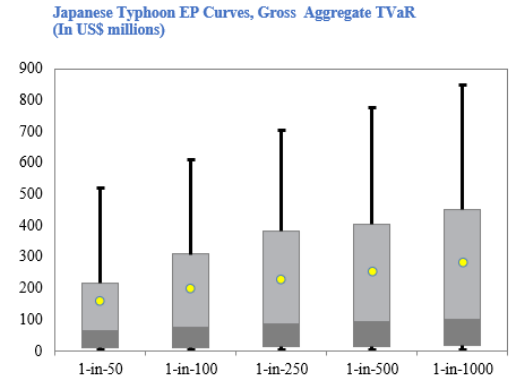
Panel 5.2 - Gross EP Curves for Named Perils (in US$ millions)







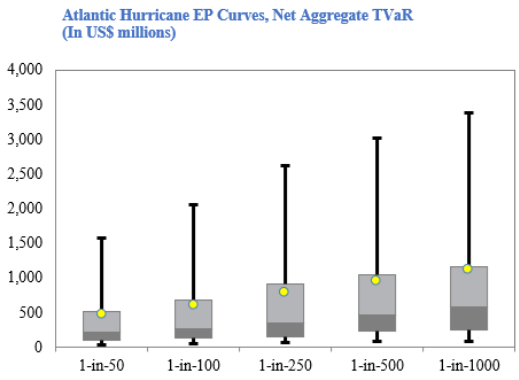


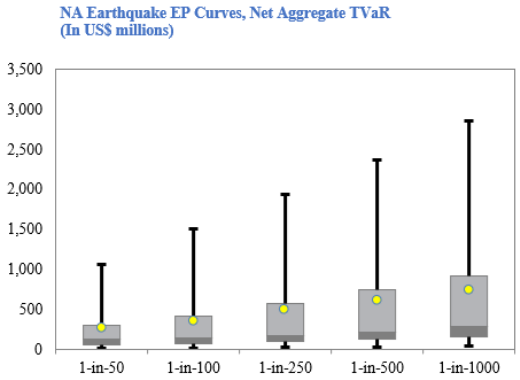


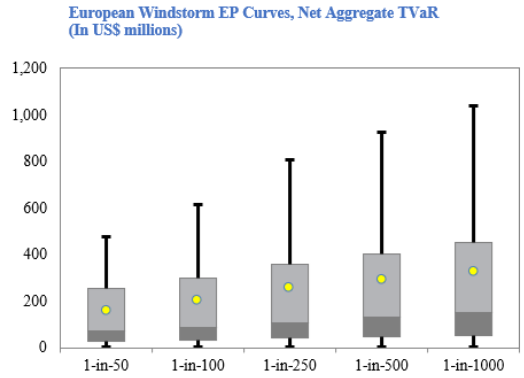
Source: BMA staff calculations.

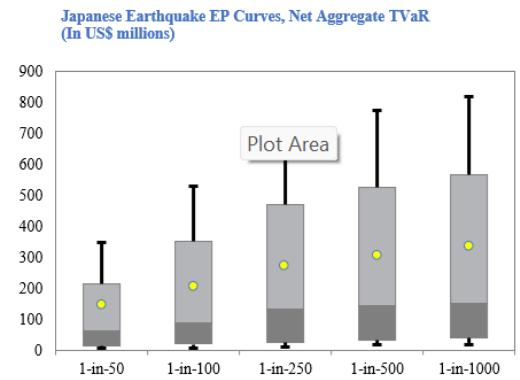
Note: Boxplots include the mean (yellow dot), the 25th and 75th percentiles (grey box, with the change of shade indicating the median) and the 10th and 90th percentiles (whiskers).

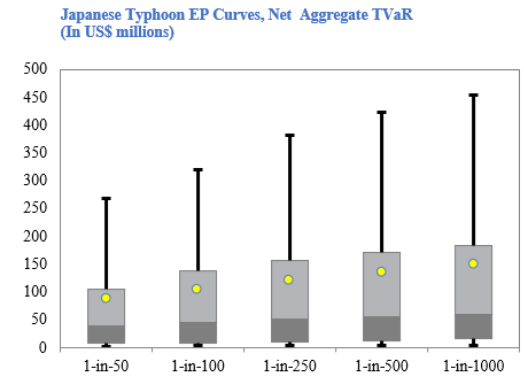
Panel 5.3 - Net EP Curves for Named Perils (in US$ millions)







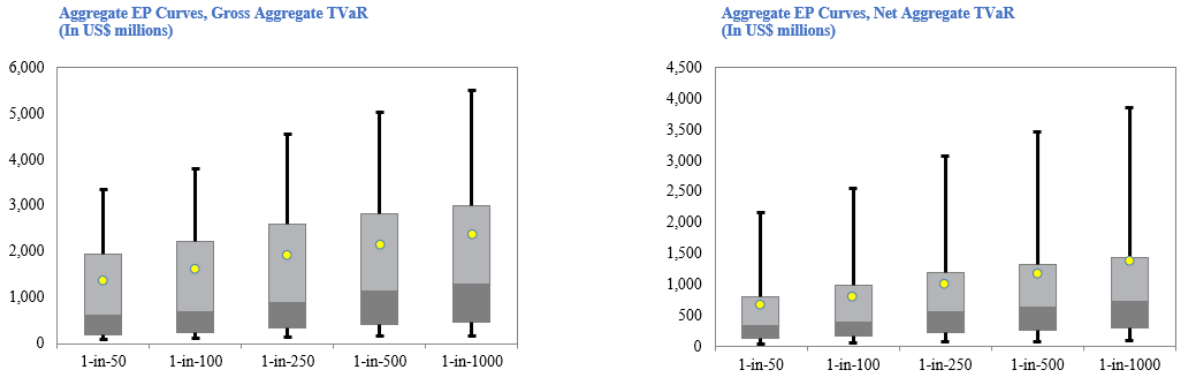




Source: BMA staff calculations.

Note: Boxplots include the mean (yellow dot), the 25th and 75th percentiles (grey box, with the change of shade indicating the median) and the 10th and 90th percentiles (whiskers).

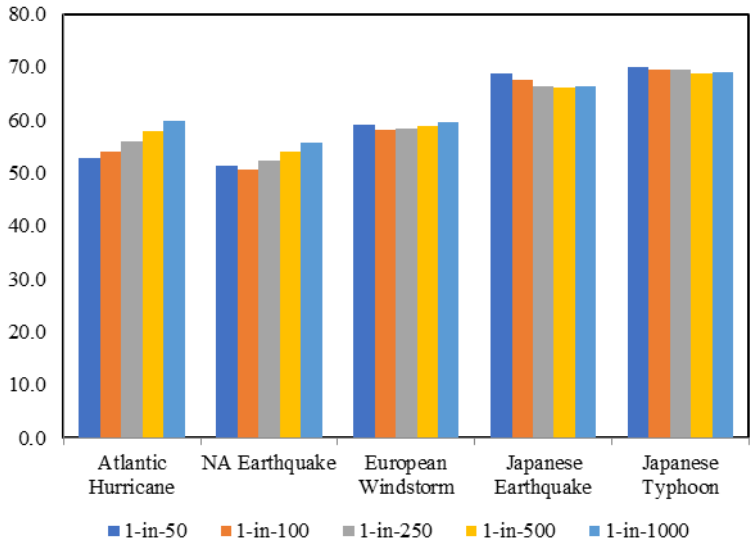
Panel 5.4 - Gross and Net Aggregate EP Curves for All Perils (in US$ millions)



Source: BMA Staff calculations.

Note: Boxplots include the mean (yellow dot), the 25th and 75th percentiles (grey box, with the change of shade indicating the median) and the 10th and 90th percentiles (whiskers).

Figure 5.1 - Average Net-to-Gross (Retained) EP Exposure per Peril and Return Period (Aggregate EP curves, in per cent)



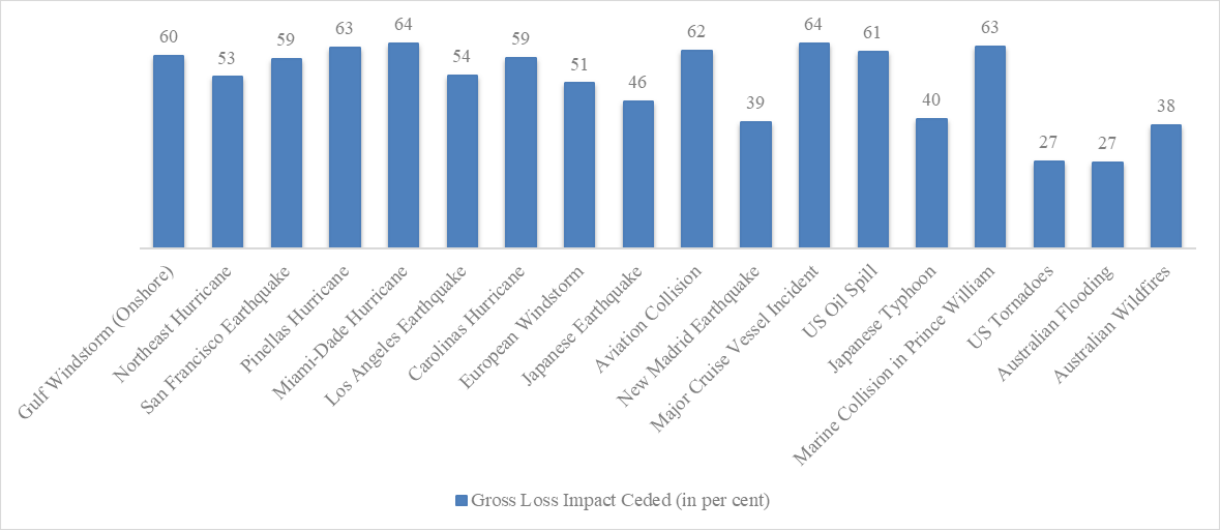
Source: BMA staff calculations.

For the Atlantic Hurricane and North American Earthquake perils, the ratio of net-to-gross exposure increased as the return period increased. The rarer the event, the more the insurer-retained risk on average. In comparison, the average proportion of exposure retained for the other perils shown was level across return periods.

6. Reliance on Reinsurance

The BMA also assesses the level of insurers' reliance on reinsurance and/or other loss mitigation instruments for each peril [9]. Overall, the aggregate loss impact results show that the level of reinsurance reliance (gross loss ceded) decreased by 2.00% compared to last year and varied across each peril (see Figure 6.1 below). This is compared with a slight increase in the aggregate loss impact and indicates that insurers retain more exposure in both 2023 and 2024. Typically, the risks that could lead to the largest financial losses are often heavily reinsured. These included the Gulf Windstorm, Miami-Dade Hurricane, Pinellas Hurricane and San Francisco Earthquake.

Figure 6.1 - Gross Loss Impact Ceded (in per cent)

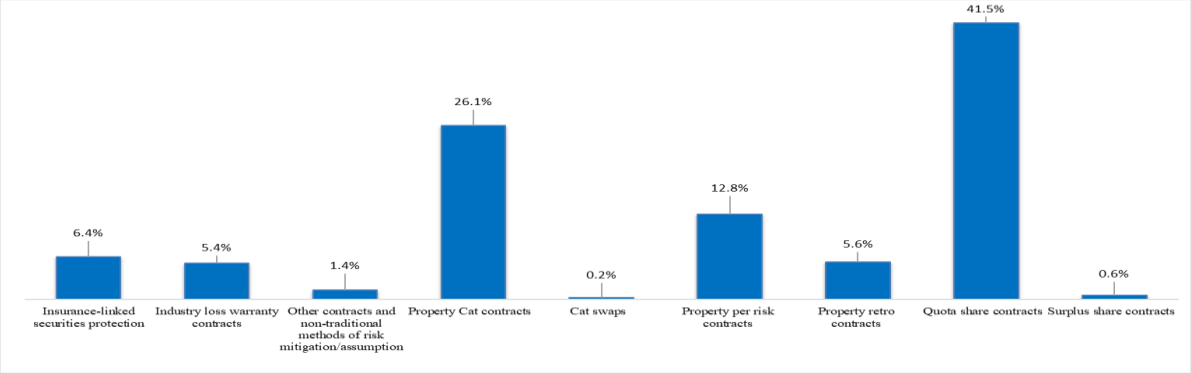


Source: BMA staff calculations.

Based on the major perils and regions outlined above, insurers are estimated to have ceded approximately 56.8% of gross losses in 2024, compared to 57.9% in 2023. Bermuda insurers employ a range of reinsurance strategies to manage catastrophe exposures, including traditional property catastrophe contracts, quota share agreements, Insurance-Linked Securities (ILS) and industry loss warranties. Data collected by the BMA indicates that property catastrophe and quota share contracts accounted for 67.6% of ceded exposure in 2024, down from 73.5% in 2023. Notably, the use of property-per-risk contracts increased significantly in 2024.

[9] Bermuda is predominantly a reinsurance-based international financial centre; thus, 'insurers' reliance on 'reinsurance' for the purpose of this section includes insurance and reinsurance undertakings that reinsure their risks with other reinsurance undertakings, i.e., retrocession.

Figure 6.3 - Reinsurance Strategy - Aggregate Occurrence Limit (in per cent)



Source: BMA staff calculations.

7. Cat Risk Underwriting Scenarios

The BMA conducts catastrophe risk stress testing through a structured three-tier framework:

1. **Level One – Standardised Scenarios**

   At this level, the BMA applies Lloyd's Realistic Disaster Scenarios (RDS) alongside additional scenarios developed internally by the Authority. Each insurer is required to estimate the potential loss impact for 18 standardised catastrophe underwriting loss scenarios. Comprehensive details of these scenarios, including the key assumptions used to guide market share estimates, are available on the BMA website (see Section 3 – Methodology).

2. **Level Two – Insurer-specific Scenarios**

   In addition to the standardised scenarios, insurers must submit loss estimates for various scenarios, including mortgage, insurer-designed underwriting loss scenarios, liability accumulation, and terrorism. These scenarios are intended to reflect the insurer's unique risk profile and complement the standardised stress tests.

3. **Level Three – Worst-case Scenario**

At the final level, insurers are required to provide an estimate for their worst-case underwriting loss scenario. This assessment must be based on the insurer's independent assumptions and internal modelling methodologies.

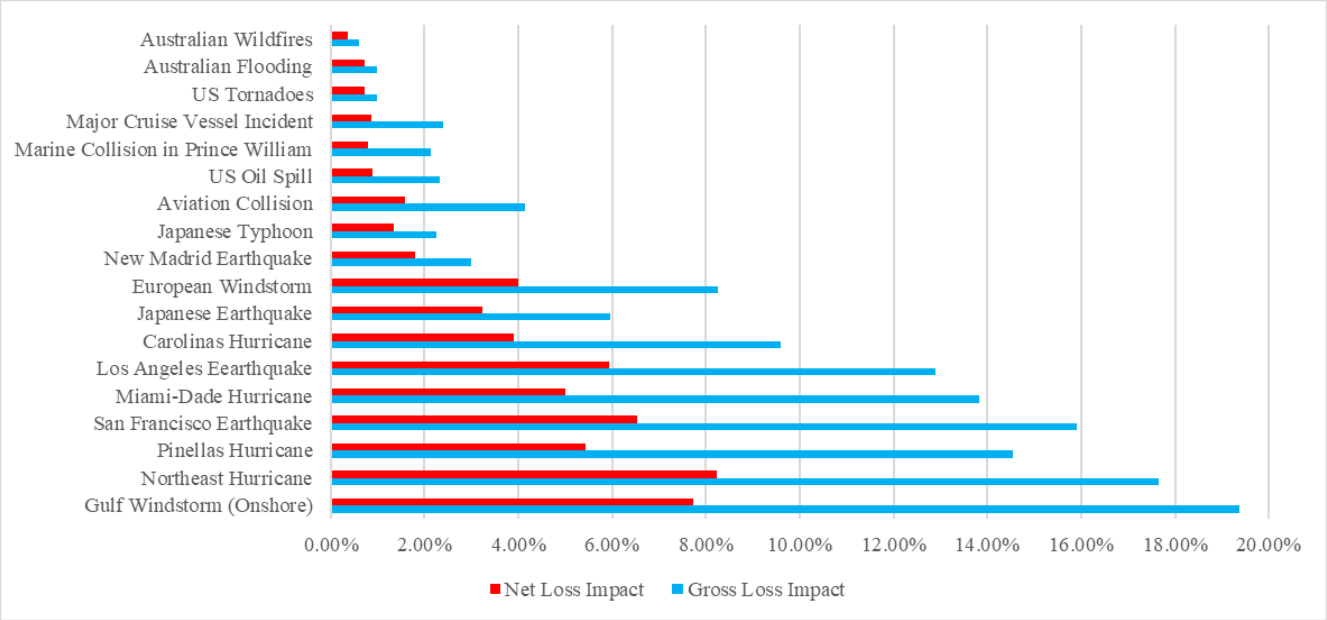
Cat risk scenarios

In general, the 2024 Cat underwriting loss scenario results show that the Bermuda insurance market is resilient to potential underwriting loss impacts arising from all major catastrophe perils underwritten and that insurers are meeting regulatory capital requirements by holding satisfactory capital to settle policyholder obligations.[10] Out of the 18 standardised underwriting loss scenarios, the Gulf Windstorm (onshore) peril had the largest potential adverse effect with an estimated gross loss impact to total sector statutory capital and surplus of 19.37% (and 7.74% net loss impact), followed by the Northeast Hurricane peril, which had the potential to deplete 17.65% (and 8.22% net loss impact) of the Bermuda market's total statutory capital and surplus.[11],[12] The Australian Wildfire peril had the least impact, with only 0.61% gross and 0.37% net impact on the total statutory capital and surplus. The gross impact from each of the other perils ranges from 0.99% to 14.54%, with many perils incurring a gross loss impact of less than 10%, as shown in Figure 7.1.

[10]The underwriting loss impact and associated assumptions reported by insurers are probabilistic estimates. Actual losses will differ from these estimates.
[11]Gross loss impact is calculated before any reinsurance and/or other loss mitigation instruments.
[12]Total capital and surplus include only capital and surplus for insurers that underwrite Cat risk (i.e., capital and surplus for insurers that do not underwrite Cat risk are not included).

Figure 7.1 - Stress Testing - Cat Loss Scenarios

(per cent of Total Capital and Surplus)



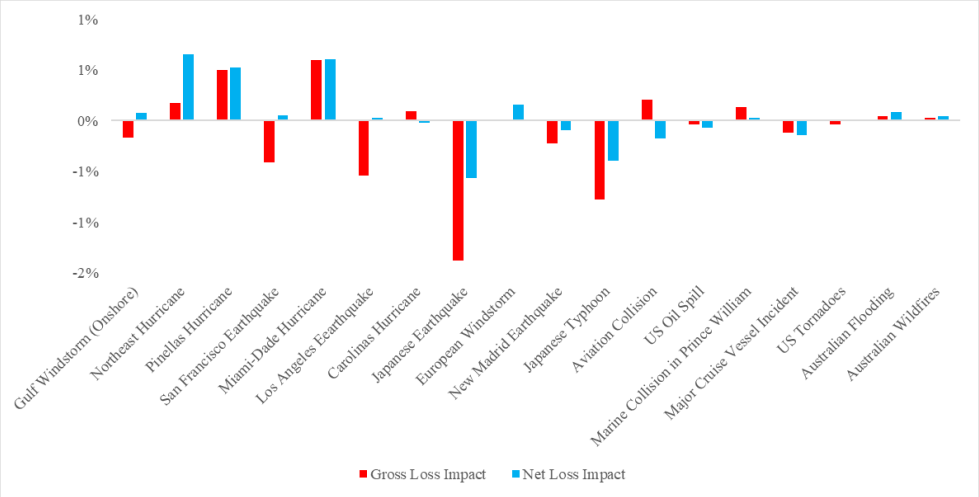
Source: BMA staff calculations.

Source: BMA staff calculations.

YoY, the sector's gross exposure increased by 7.52% or $15.37 billion based on the standardised Cat perils. Exposure ceded, as estimated by these Cat perils, increased 5.36% or $6.35 billion. This indicates that insurers retained most of the growth ($9.01 billion) as net loss exposure, which increased by 10.49%. Insurers' YoY aggregate statutory capital and surplus increased by 7.3% in 2024, which is commensurate with the growth in gross and net loss exposure.[13] The distribution of risk across the perils remained stable YoY.

[13] The increase in capital and surplus is driven primarily by the increase in the level of capital held by several insurers.

Figure 7.2 – YoY (2020 and 2021) Gross and Net Loss Impact Change (in per cent)



Source: BMA staff calculations.

Other underwriting loss scenarios

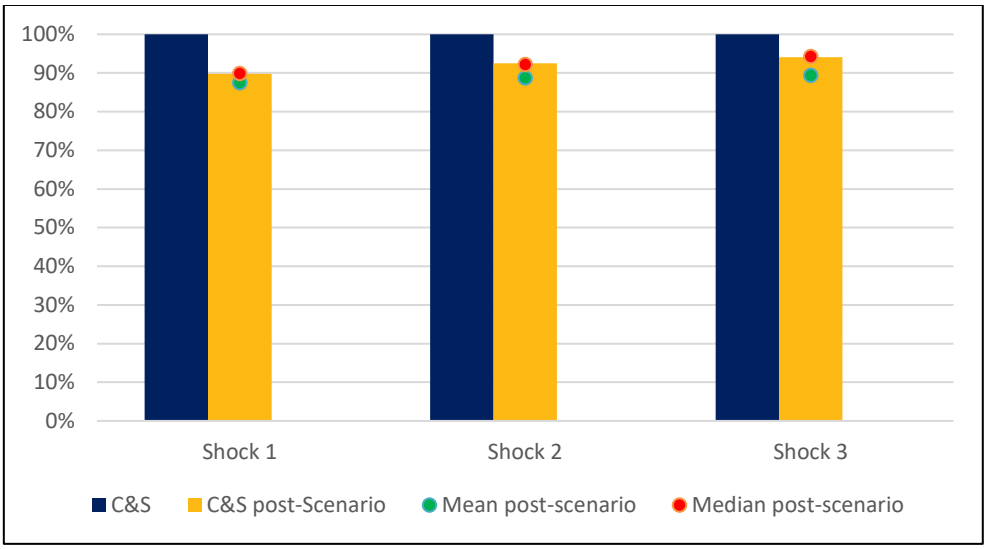
In certain instances, the standardised catastrophe risk scenarios outlined above may not fully apply to an insurer's portfolio, resulting in negligible (de minimis) loss projections. In such cases, the insurer is required to submit three bespoke underwriting loss scenarios. This requirement typically applies to insurers with significant specialty and/or casualty exposures, where potential losses from these lines of business exceed those from property risks.

For each of the three scenarios, insurers must provide:

- A detailed description of the scenario, including all key assumptions underpinning the analysis
- Post-stress positions for aggregate statutory assets and statutory liabilities immediately following the event, presented both **with** and **without** the effect of reinsurance and other loss-mitigation instruments

Figure 7.3 illustrates the results derived from these insurer-specific scenarios.

Figure 7.3 - Capital and Surplus (C&S) Post Other Underwriting Loss Scenarios



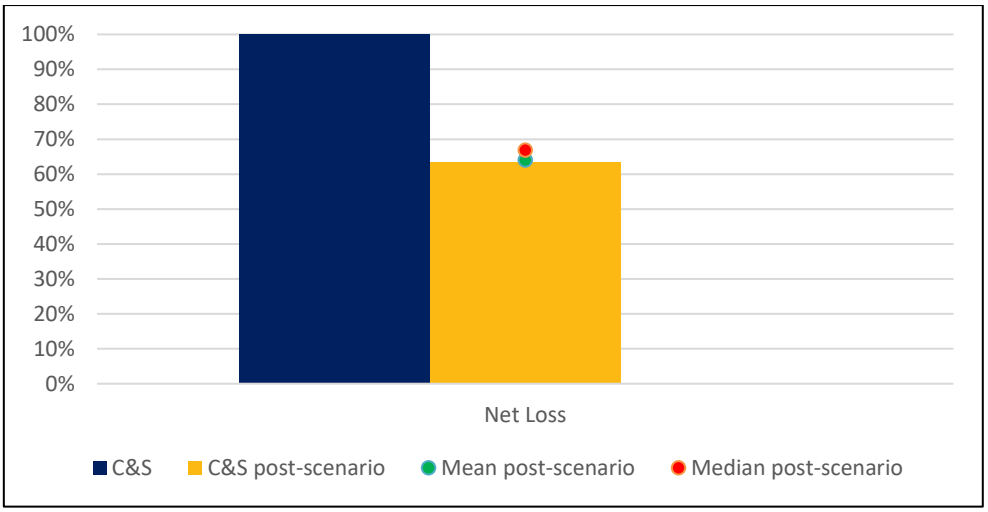
Source: BMA staff calculations.

As shown in Figure 7.3, insurers could comfortably withstand these scenarios, with most retaining a high percentage of their statutory capital and surplus in each case. Across these scenarios, the average mean and median total capital and surplus remaining post-event by Bermuda insurers were 89.23% and 92.56% of original capital and surplus, respectively.

Insurer's own worst-case scenario

An insurer's own worst-case scenario presents a more severe impact and is generally the insurer's most remote and extreme test. The net mean and median post-stress capital and surplus returned by Bermuda insurers for this scenario were 64.00% and 66.89%, respectively (see Figure 7.4).

Figure 7.4 - Capital and Surplus Post Insurer's Own Worst-Case Scenario



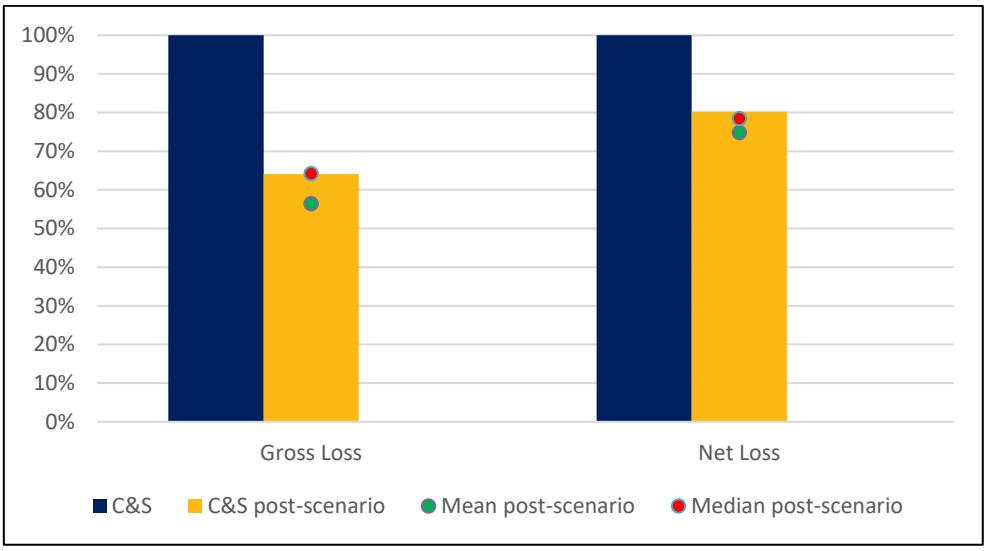
Source: BMA staff calculations.

Loss simulations scenario

Insurers were required to run a series of loss simulations or other analyses related to extreme tail events, including all policies at the beginning of the year. These scenarios were substantiated by the relevant underlying assumptions.

The results of a series of loss simulations or other analyses related to extreme tail-event scenarios show that, on a gross basis, the mean total capital and surplus is depleted to 56.37% of the original total capital and surplus post-event. The median total capital and surplus is depleted to 64.20% of the original total capital and surplus on a gross basis. Nevertheless, after factoring in the exposure ceded, the post-stress capital and surplus for the majority of insurers is significantly higher (i.e., mean of 74.79% and median of 78.38% - see Figure 7.5).

Figure 7.5 - Capital and Surplus Post Loss Simulations – Tail Events



Source: BMA staff calculations

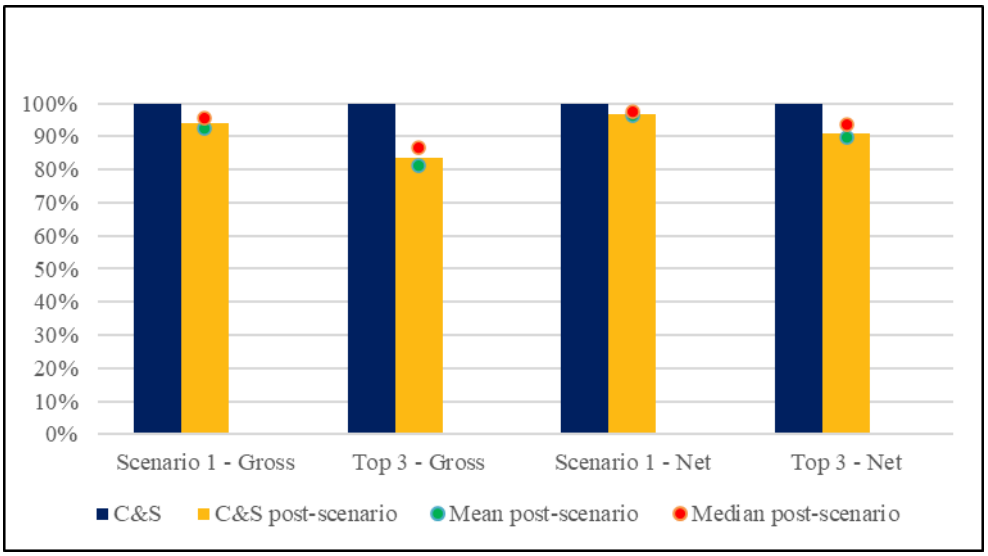
8. Terrorism, Cyber Risk and Mortgage Insurance Scenarios

Terrorism stress scenario

The BMA requires insurers to conduct a separate stress test for terrorism coverage by submitting the top ten modelled losses from a standardised scenario involving the explosion of a two-tonne bomb.[14] Based on the single largest loss for each insurer, on average, insurers retained 91.86% of the statutory capital and surplus on a gross basis and 96.27% on a net basis.[15] When analysing the top three most significant terrorism losses, the results illustrate that all the insurers' balance sheets comfortably withstood the impact of their most extensive terrorism exposures combined (i.e., insurers will retain, on average, 81.38% of the statutory capital and surplus on a gross basis and 89.89% on a net basis – see Figure 8.1).

[14] For a detailed description of this scenario, please refer to the BMA's Cat Risk Return Guidelines.
[15] The benefit from the diversification of the single largest loss across insurers is not accounted for in the aggregation, leading to conservatism in this estimate.

Figure 8.1 – Capital and Surplus Terrorism Stress Scenario



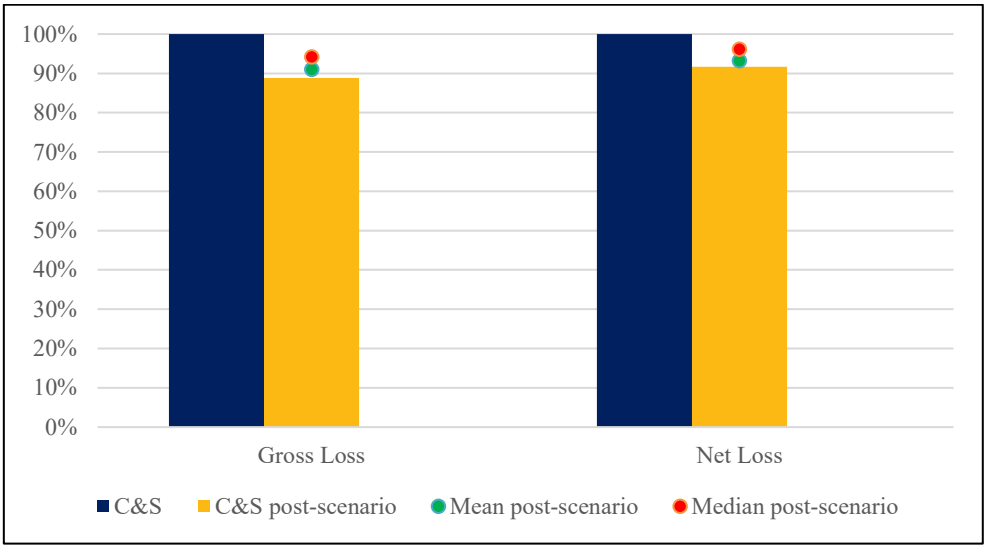
Source: BMA staff calculations.

Cyber stress scenario

Insurers were required to provide data on cyber risk, including their estimated total exposure, worst-case annual aggregate loss scenarios, and the underlying assumptions associated with these estimates. The insurance-specific cyber stress scenario data show that insurers' own worst-case impacts from cyber risk have had a minor effect on their statutory capital and surplus, both on a gross and net basis. It also shows the mean and median statutory capital post the cyber risk stress were 91.04% (93.20% net) and 94.22% (96.13% net), respectively (see Figure 8.2).[16]

[16] The BMA publishes a separate annual *Bermuda Cyber Underwriting Report* that can be found on the BMA's website: https://www.bma.bm/pdfview/9656

Figure 8.2 - Capital and Surplus Cyber Stress Scenario



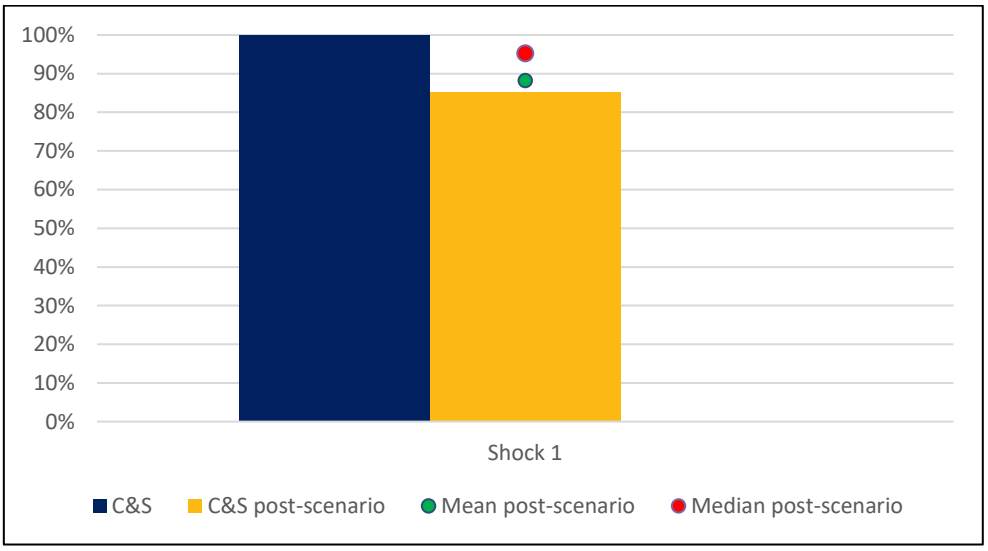
Source: BMA staff calculations.

Mortgage insurance scenario

For year-end 2024 insurers that wrote mortgage business were required to shock their exposure by immediately increasing the default rate to 9.47%, which is equivalent to approximately 99.5% Tail Value at Risk (TVaR) for their mortgage book.

In addition to the increased default rate, insurers that held agency Mortgage-Backed Security (MBS) and securities as investment assets subject to prepayment risk were required to shock these investments by assuming that the MBS prepay at an annual Constant Prepayment Rate (CPR) of 40% instantaneously. If the 40% CPR produced capital gains, the insurer had to stress the CPR at 0%, 5% and 10%. The expectation is that if using a CPR of 40% produces a gain, then applying a substantially lower MBS prepayment shock rate of 10% or less will likely produce capital losses. Figure 8.3 illustrates the results from this scenario.

Figure 8.3 - Capital and Surplus Mortgage Insurance Loss Scenario



Source: BMA staff calculations.

The results of these scenarios show that the mean and median post-stress capital and surplus returned by Bermuda insurers were 88.26% and 95.28%, respectively.

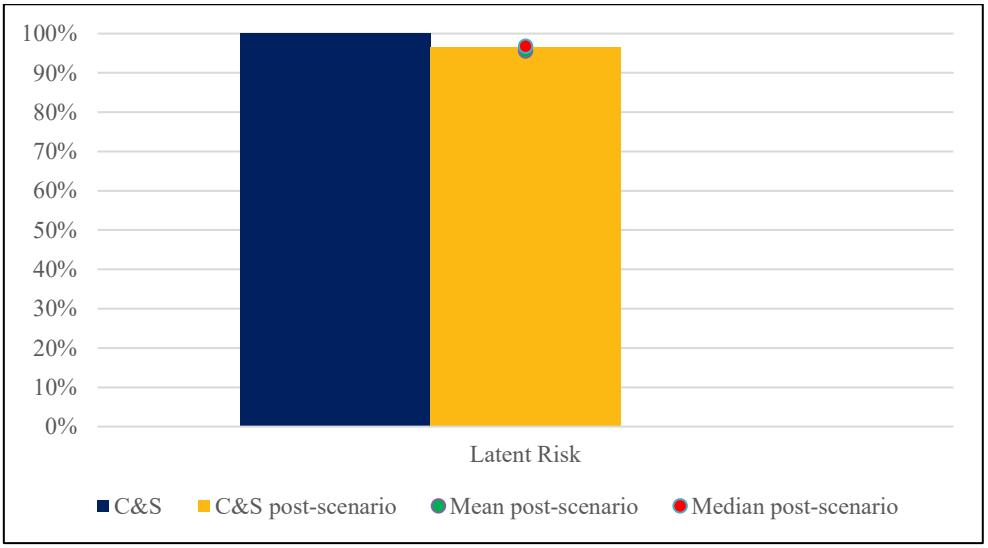
9. Liability Loss Accumulation Scenarios

Insurers are also required to run stress tests on scenarios that estimate potential accumulations of insurance loss relating to liability exposures. The scenarios aim to capture risk in liability exposures that are generally not adequately reflected in historical claims experience. Such risks tend to materialise slowly and impact many years of exposure. Specifically, insurers had to stress their balance sheets under two separate scenarios: a new latent liability scenario and an Asbestos and Environmental (A&E) scenario that assumes deterioration in existing US A&E and UK asbestos reserves.

The new latent liability test aims to cover a 'mass tort' event. For example, a general and potentially legally enforceable opinion could emerge after a court decision characterising a

specific product or substance as causing observed or potential future adverse effects, such as bodily injury, property damage or environmental damage. This is expected during that year and the following years to lead to claims on the product liability insurance of the producers, followed by mass litigation against companies that distribute, use or have distributed or used the product or substance. These developments are expected to result in worldwide claims under general commercial liability and workers' compensation/employer liability insurance policies. The scenario assumes that the amount recognised at the end of the one-year time horizon is smaller than the maximum possible ultimate loss from the scenario, due to the incompleteness of available information and the uncertainty of subsequent development. Figure 9.1 below shows the results of this scenario with the mean and median post-stress capital and surplus returned by the Bermuda insurer at 95.54% and 96.76%, respectively.

Figure 9.1 - Capital and Surplus New Latent Liability



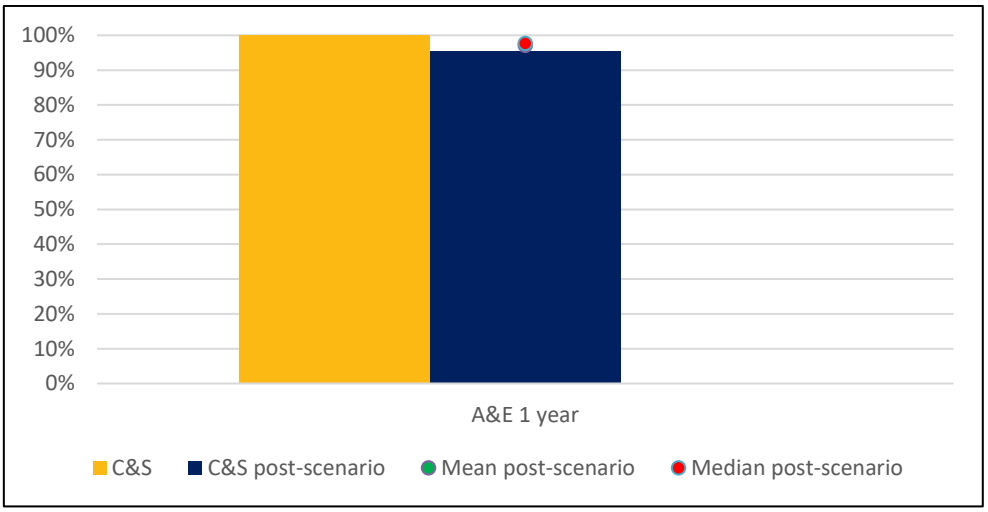
Source: BMA staff calculations.

The A&E scenario aims to reflect potential deterioration in existing US Asbestos, US Environmental and UK Asbestos reserves.[17] For the US A&E stress, the scenario considers potential under-reserving by referencing survival-ratio market benchmarks, an increase in projected claims inflation and an increase in projected asbestos claims due to medical

[17] Insurers with total US A&E and UK Asbestos net reserves of less than $50 million do not need to calculate this scenario.

advances.[18] For the UK asbestos stress, the scenario considers new claims arising beyond 2050, a deterioration in the projected number of claims up to 2050, an increase in the projected number of claims due to medical advances and an increase in projected claims inflation. Figure 9.2 below shows the results of this scenario with the mean and median post-stress capital and surplus returned by Bermuda insurers at 97.11% and 97.70%, respectively.

Figure 9.2 - Capital and Surplus deterioration from existing US A&E and UK Asbestos Reserves



Source: BMA staff calculations.

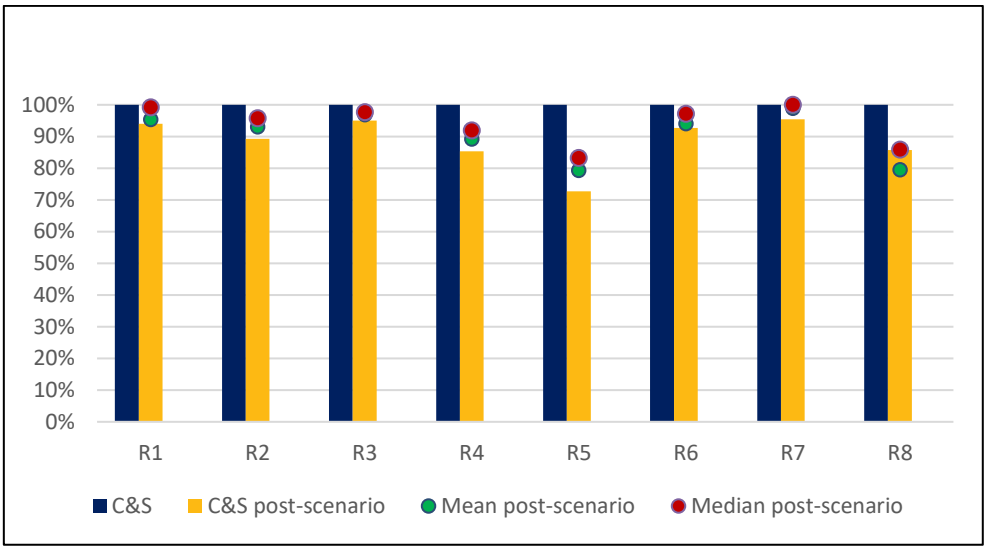
10. Financial Market Scenarios

The financial market scenarios comprise capital market-related single-factor shocks triggered by specific risk factors (i.e., equity returns, credit spreads and defaults). These shocks were calibrated using historical data on the evolution of interest rates, exchange rates and equity markets. Furthermore, given the continued sovereign risk concerns and their implications for insurers' investment performance, the financial market scenarios included haircuts on sovereign bonds. The ongoing volatility due to political risk and capital flows also warrant shocks to foreign currency positions.

[18] A survival ratio is a common market benchmark for assessing the reserve strength of A&E reserves. It is defined as the number of years that current reserves will suffice (survive) if average future payments equal average current payments.

Specifically, the insurer (depending on its exposure to capital market-related factors) was required to quantify the impact on its statutory balance sheet across eight financial market scenarios. Figure 10.1 shows the capital and surplus after these various scenario impacts.

Figure 10.1 - Capital and Surplus - Financial Market Scenarios



Source: BMA staff calculations.

R1 (Severe decline in equity prices) – This scenario assumes a decrease of 40% in the value of equities in a portfolio. This stress scenario is consistent with the 'Black Monday' crash of 1987. The result of this scenario shows that the mean and median post-stress capital and surplus returned by the Bermuda insurance market were 95.32% and 99.19%, respectively.

R2 (Alternative investment and real estate) – This scenario focuses on assets that have a low correlation with financial markets and less liquidity compared to typical financial assets. Such assets include investment holdings in hedge funds, real estate, private placements and venture capital, among others. R2 requires those assets to be decreased in value by 40%. For assets such as hedge funds with lockup periods, venture capital, and real estate in illiquid markets, the (re)insurer reported whether sudden decreases in value could prevent rapid sales and whether this effect had material consequences. The result of this scenario shows that the mean and median post-stress capital and surplus returned by the Bermuda insurance market were 92.97% and 95.71%, respectively.

R3 (Yield curve stress) – This scenario assumes moderate and severe movements in global yields. The insurer is required to stress its balance sheet for this scenario using the following yield curve scenarios.

Table 1 – Yield Curve Scenarios	
Scenario	**Stress**
Moderate Widening	1% increase in yields across all maturities
Moderate Tightening	1% decrease in yields across all maturities
Severe Widening	2% increase in yields across all maturities
Severe Tightening	2% decrease in yields across all maturities

The result of this scenario shows that the mean and median post-stress capital and surplus returned by the Bermuda insurance market were 96.82% and 97.69%, respectively.

R4 (General widening of credit spreads) – This scenario assumes that credit spreads widen across different rating classes. The widening reflects an increase in perceived credit risk in the market. The insurer was required to stress all positions, including those available for sale and held to maturity. Structured finance products, asset-backed securities and agency and non-agency MBSs also had to be included. If there was no rating for an asset, the insurer needed to assume that the rating was below BB. The result of this scenario shows that the mean and median post-stress capital and surplus retained by the Bermuda insurance market were 89.15% and 91.90%, respectively.

R5 (R1 to R4 combined) – This is the most severe financial market scenario as it assumes a combination of a decrease of 40% of the value of equities in a portfolio (R1), a reduction in the value of alternative investment and real estate (R2) by 40%, US yield curve stress (R3) and credit widening across different rating classes (R4). The results showed that most insurers can withstand this scenario, with the mean and median post-stress capital and surplus in the Bermuda insurance market at 79.30% and 83.16%, respectively.

R6 (Foreign currency shocks) – This scenario assumes an equal percentage, provided by the Authority, of depreciation and/or appreciation of foreign exchange positions in both assets and liabilities. The result of this scenario shows that the mean and median post-stress capital and surplus returned by the Bermuda insurance market were 94.05% and 97.17%, respectively.

R7 (Escalation of sovereign risk) – This scenario assumes certain sovereigns will have to undergo a haircut in the face value of their debt. Both available-for-sale and held-to-maturity bonds were stressed. The haircuts were based on the realisation of a prolonged pan-European banking crisis, which led to sovereign defaults. Only a handful of Bermuda insurers are exposed to this scenario. The result of this scenario shows that the mean and median post-stress

capital and surplus returned by the Bermuda insurance market were 98.85% and 99.93%, respectively.

R8 (Inflation and monetary policy risk) – For this scenario, insurers have to apply a moderate (+5%), severe (+10%) and deflationary (-1%) scenario for three years that assumes no initial action was taken to curb inflation from central banks. In year four, the central bank changes its stance and increases rates to restore the current real interest rate. From year five onwards, inflation and interest rates return to current levels. Higher-than-expected inflation decreased the real yield on loans and debts, while it may increase the value of indemnities, claims and expenses. This scenario is similar to the 2024 inflationary scenario. The mean and median post-stress capital and surplus after the severe inflationary scenario returned by the Bermuda insurance market were 79.43% and 85.84%, respectively.

In addition to the above scenarios, insurers were required to submit a detailed qualitative disclosure of the impact of a rating downgrade of two notches or more on their Bermuda legal entities or groups, below A-, whichever was lower. The disclosure needed to cover and indicate the relative impact/severity of collateral requirements, loss payment triggers on in-force policy contracts, clawbacks and/or other adverse financial and liquidity implications of the downgrade.

Appendix I - The Bermuda Framework for Cat Risk Supervision

As one of the world's leading property catastrophe reinsurance hubs, Bermuda maintains a comprehensive supervisory framework for Cat risk. This framework is built on three key pillars:

1. **Catastrophe Capital Charge in Prudential Filings**

   Insurers are required to maintain a capital charge for Cat risk as part of their overall solvency capital requirement. This charge combines a BMA-prescribed factor with an insurer-specific factor provided by the company. Once calculated, the Cat risk capital charge is integrated into the overall capital requirement to account for diversification benefits.

   Prudential filings include schedules dedicated to Cat risk reporting. The Cat risk-return questionnaire captures both qualitative and quantitative information. Qualitative disclosures cover the insurer's Cat risk modelling processes, including the types of models and their frequency of use. Quantitative disclosures include AALs, PMLs and EP curves for major perils.

2. **Supervisory Assessment of Prudential Filings**

   The BMA validates the prudential filings through a structured supervisory process. Given that part of the Cat risk capital charge calibration depends on insurer assumptions, the Authority employs various tools for cross-validation, including the Cat risk-return data.

   Additionally, the BMA prescribes stress tests based on Lloyd's RDS, which insurers must report in their filings. Insurers are required to demonstrate their capital position before and after applying the relevant RDS and provide additional scenarios in which the standard RDS does not adequately capture their portfolio exposures. Furthermore, insurers must conduct a reverse stress test and identify conditions that would render their business non-viable.

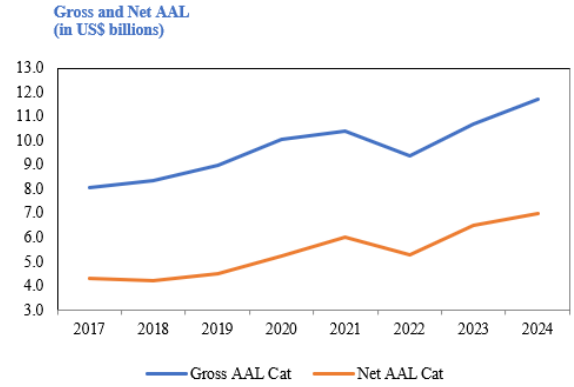
3. Public Disclosure of Aggregated Cat Risk Data

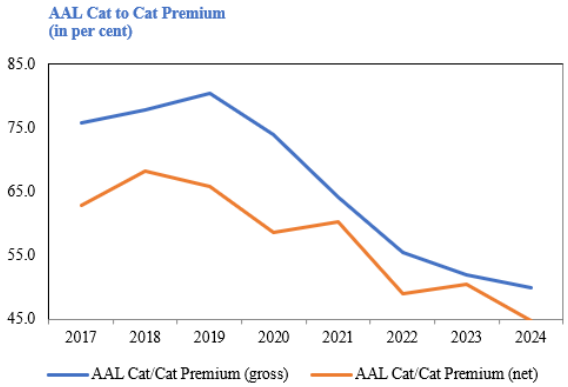
The BMA publishes aggregated Cat risk-return data for the Bermuda market as part of its macroprudential surveillance framework. This enhances transparency and supports market-wide risk monitoring.

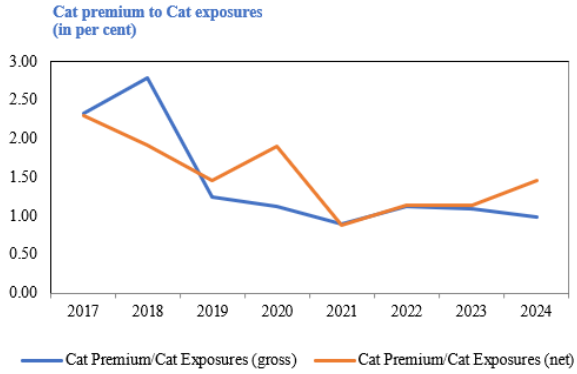
Appendix II - Pricing Dynamics

The following panel shows the pricing dynamics of the Bermuda Cat market over time based on aggregated data only.

Panel 1. AAL, Risk and Pricing Ratios[19]







YoY, the gross Cat AAL increased to US$11.72 billion in 2024 from US$10.70 billion in 2023. Similarly, the net AAL increased to US$7.00 billion in 2024 compared to US$6.49 billion in 2023.

Panel 1 plots the risk and pricing dynamics to show the ratios of the Cat AAL to Cat premium on both a gross and net premium basis. The AAL represents the modelled estimation of the expected Cat losses, and the gross premium includes provisions for profit and expenses. The relationship between these gross and net ratios indicates the amount of costs, profit and other loadings charged to insured entities. The BMA observes that, on average, the gross and net ratios have steadily decreased over the last three years. For 2024, the gross ratio is 49.95%,

[19] The BMA only uses modelled exposures and premium.

while the net ratio is 44.70%. Decreases in this ratio indicate higher expenses, higher costs of capital, or higher loadings, or a more robust pricing environment, which is consistent with the hardening of the insurance market and the reduction of Cat exposure by Bermuda insurers.

The BMA also plots the ratio of modelled Cat premium to Cat exposures, as shown in the second row of Panel 1. For 2024, the ratio decreased slightly on a gross basis to 0.99% from 1.10% in 2023, while on a net basis, it rose to 1.46% from 1.13% in 2023.