BANK OF ENGLAND
PRUDENTIAL REGULATION AUTHORITY

Please note: This letter has been prepared for the website. Square brackets show where this letter may differ slightly from those versions sent directly to firms.

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17 June 2020

Dear CEO,

Letter sent to participating firms

Insurance Stress Test 2019 and Covid-19 stress testing: feedback for general and life insurers

Thank you for participating in the 2019 Insurance Stress Test (IST 2019) exercise and our more recent engagement on Covid-19 stresses. Stress testing continues to be a valuable tool for the PRA in pursuing a forward-looking, proportionate and judgement-based approach to supervision.

IST 2019 was the third PRA exercise for general insurers and the first one for life insurers since the introduction of Solvency II. This exercise incorporated asset and liability shock scenarios as well as a number of exploratory scenarios, including a climate change exercise.[1]

For general insurers, in recognition of the reliance on Bermuda-based reinsurers, we conducted our first joint exercise with the Bermuda Monetary Authority (BMA) for natural catastrophe scenarios, supporting our joint commitment to supervisory cooperation, in line with the Insurance Core Principles of the International Association of Insurance Supervisors.[2]

Stress testing the industry in relation to Covid-19 (Annex 1)

In order to assess the ability of the insurance sector to withstand potential further stresses which might be caused by the Covid-19 pandemic, we conducted further resilience testing of firms during April. Our analysis used the illustrative scenario outlined in the May 2020 Monetary Policy Report[3] and further severe asset and insurance shocks tailored to stress the different risks to which different types of insurance firm are exposed.

Our analysis showed that the sector was robust to downside stresses, with the highest uncertainty centred on certain general insurers' liabilities – particularly those arising from business interruption claims. To ensure that the sector remains robust in this evolving situation, we expect firms to maintain close monitoring of the additional risks presented by Covid-19, update their risk and capital assessments as the situation evolves and take appropriate management actions where necessary.

Further details of our work in this area are set out in Annex 1.

IST 2019 – general insurers (Annex 2)

This third biennial stress test has again suggested the industry is resilient to natural catastrophe risks. As in previous exercises, this is reliant on significant levels of reinsurance, particularly from Bermuda. Results from our joint exercise with the BMA indicate that Bermuda-based reinsurers are resilient to the stresses examined in the exercise; and that they also rely heavily on reinsurance, and in particular the capital markets via Insurance Linked Security structures.

1 https://www.bankofengland.co.uk/prudential-regulation/letter/2019/insurance-stress-test-2019.
2 https://www.iaisweb.org/page/supervisory-material/insurance-core-principles.
3 https://www.bankofengland.co.uk/report/2020/monetary-policy-report-financial-stability-report-may-2020.

Our current focus is on the impact of Covid-19 and the associated stress testing work, but we highlight three areas for further work by industry in the estimation of insured losses from natural catastrophe scenarios:

- Allowance for risks not captured within standard models (typically because the product, such as contingent business interruption, or type of event, such as a secondary peril, is not captured in the model).

- Allowance for secondary perils in light of recent experience (such as inland flooding following a hurricane).

- Data quality.

The exploratory scenarios identified areas for further development in the industry's ability to assess cyber-related and sectoral (across economic sector) exposures.

IST 2019 – life insurers (Annex 3)

As on the general insurance side, our current focus is on the impact of Covid-19 and the stress testing work set out in Annex 1. However, last year's life insurance stress test – the first such test since the implementation of Solvency II – provides valuable learnings as we continue to develop our concurrent stress-testing framework for insurers.

For the PRA, the exercise highlighted areas around the design and specification of our scenarios, where we will develop further our methodology.

Annex 3 provides further detail on these findings and we will work with firms to take these forward.

IST 2019 – climate scenario (Annex 4)

The intention of the climate scenario was exploratory – enabling the Bank of England (Bank)/PRA to understand market capabilities and to help inform the design and specification choices for the Bank/PRA climate biennial exploratory scenario (BES). The exercise was designed to provide market impetus in developing climate scenarios, and for many firms this was the first time they had conducted such a stress test.

This is a challenging undertaking, but the responses have highlighted the areas on which we and the industry will need to focus as we develop our climate stress testing capabilities further:

- For the industry **–** the exercise has highlighted gaps in capabilities, data and tools to evaluate climate-related scenarios. These will need to be filled before firms can start to align their strategy to specific emission transition trajectories.

- For the PRA/Bank **–** the exercise has provided valuable learnings on scenario design, specification and reporting, and we will take forward work on these.

Next steps

We will work closely with industry to take these findings forward. We expect boards to assess whether the findings apply to their firm and present an action plan to their supervisors to address them. Given the current uncertainty and demands arising from Covid-19, we understand that firms may need longer to address these, and this will be taken into consideration. Looking further ahead:

- **Next Insurance Stress Test:** to alleviate the burden on firms in light of the Covid-19 impact and allow them and us to focus on Covid-19 stresses, the next concurrent insurance stress test will occur in 2022.

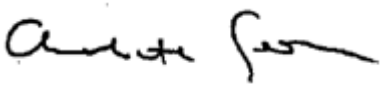
- **Climate Biennial Scenario:** recognising current pressures on firms, and in light of the responses to the December 2019 Discussion Paper on the Climate Biennial Exploratory Scenario, the PRC and FPC have agreed to postpone the launch of the exercise until at least mid-2021.

- **Development of a cyber-stress test:** the PRA intends to engage with the general insurance industry to develop a cyber-scenario in time for the 2022 insurance stress test exercise.

Additional results and observations for IST 2019 are contained in the Annexes to this letter and we hope you find these of interest. If you wish to discuss these results, or have any additional insights you want to share, please speak with your usual supervisory contact to arrange a meeting.

Yours sincerely,

Anna Sweeney
Executive Director, Insurance



Charlotte Gerken
Executive Director, Insurance

ANNEX 1: Stress testing the industry in relation to Covid-19

In order to assess the ability of the insurance sector to withstand potential further stresses which might be caused by the Covid-19 pandemic, we conducted during April further resilience testing of firms. Our analysis used both the illustrative scenario outlined in the May 2020 Monetary Policy Report (MPR) and further severe asset and insurance shocks tailored to stress the different risks to which different types of insurance firm are exposed.[4]

Our analysis showed that the sector was robust to downside stresses, with the highest uncertainty centred on certain general insurers' liabilities – particularly those arising from business interruption claims. To ensure that the sector remains robust in this evolving situation, we expect firms to maintain close monitoring of the additional risks presented by Covid-19, update their risk and capital assessments as the situation evolves, and take appropriate management actions where necessary.

1 Life insurers

For life insurers, our Covid-19 resilience analysis centred on a further economic deterioration, above that experienced during the first three months of 2020, and in particular aimed to capture the impacts of credit downgrades as a key risk for life insurers with matching adjustment portfolios.

The stress applied was in addition to the changes in financial markets already seen during Q1 2020, most notably falls in the level of nominal interest rates and equity markets. In addition to asset price falls, spread-widening and falls in risk-free interest rates, our analysis tested a 50% downgrade of assets by one credit quality step (CQS) (i.e. a whole single letter downgrade, such as A to BBB). We focus on credit downgrades because these affect both the value of credit risky assets life insurers hold and (on the other side of the balance sheet) the level of matching adjustment benefit firms can claim, the net effect of which can have a significant impact on life insurers' solvency ratios. This 50% downgrade scenario is broadly equivalent to the worst one-year experience in history, felt during the Great Depression in 1932. We could have additionally allowed for defaults explicitly, but historically these have been very low and it was more practical to allow for this implicitly within the chosen allowance for downgrades, which was higher than that experienced in 1932. The stresses were applied instantaneously to life firms' balance sheets, and did not allow for the management actions that firms would have time to apply in reality, and which would provide some off-setting benefit to their capital positions.

The work provides us with a good relative measure of the risks faced by individual firms, and a means to assess how rigorously each firm and its board are assessing their position against their own risk appetites. The results of this resilience exercise showed that, for the reasons set out above, most firms are sensitive to a severe downgrade stress of this kind, but that it would be manageable, particularly given that firms have a range of management actions available to absorb losses which tend to arise over a reasonable timeframe. This work has informed supervisory dialogue with each firm and will continue to be refreshed as the Covid-19 situation develops.

2 General insurers

General insurers' business models typically have lower levels of investment risk than life insurers, but have greater sensitivity to liability stresses. Therefore, in addition to stressing assets, for general insurers we also made non-life insurance specific assumptions and applied further stresses, including:

- underwriting losses based on the GDP path and length of lockdown in the MPR scenario;
- stresses on revenues and earnings due to premium holidays, lower economic activity, and/or an increase in bad debts; and
- further liability stresses, including from business interruption claims.

[4] https://www.bankofengland.co.uk/report/2020/monetary-policy-report-financial-stability-report-may-2020.

This exercise showed that the general insurance sector is resilient to these stresses under the assumption that the insurance policies work in line with insurers' current expectations. However, there are differences between insurers and policyholders as to the interpretation of some business interruption contract wordings in the context of the COVID-19 pandemic. To test this sensitivity, we stressed the assumptions made by firms around the robustness of their policy wordings. This showed that the sector was in aggregate resilient, but the level of uncertainty is high and some more severe scenarios could have a significant impact on the capital positions of a few firms.

The FCA is seeking a court declaration on a number of test cases to provide clarity for policyholders and firms as to how these business interruption wordings should be interpreted. We support this initiative and will work with the FCA and firms to understand the potential financial impact of the court case.

ANNEX 2: General insurers – IST 2019 results and feedback

1 Introduction

The 20 largest PRA-regulated general insurers, 15 large syndicates[5] and the Society of Lloyd's participated in this stress test exercise. These entities accounted for £74 billion of gross written premium, representing approximately three-quarters of the UK general insurance sector.

The stresses included an asset shock, four natural catastrophes (NatCat) and a reserve deterioration scenario. In addition, an exploratory section contained a climate and cyber-underwriting scenario and requested firms to provide information on sectoral exposures.

We coordinated parts of our exercise with the Bermuda Monetary Authority (BMA). This reflects the significant reliance on reinsurance recoveries from Bermuda-based firms following a large natural catastrophe scenario. The BMA results are available at https://www.bma.bm/publications/bma-surveys.

The full details of the scenarios and their design are available in our letter of Tuesday 18 June 2019.[6]

2 Sector resilience and counterparty dependencies

The PRA-regulated general insurance market is resilient to the asset shock and NatCat scenarios, with aggregate market solvency ratios remaining above 100%. A number of entities are expected to breach their solvency coverage (before allowance for management actions), although no firm/syndicate is expected to become insolvent.

Table 1: Solvency ratios and possible regulatory breaches (a)(b)

All Amounts in £bn [1:1.3 USD] **(as at 31/12/2019)**	**Scenario A1:** **Asset Shock**	**Scenario B1:** **Set of 3 US Hurricanes**	**Scenario B2:** **California Earthquake**	**Scenario B3:** **Japanese EQ & Tsunami**	**Scenario B4:** **UK Windstorm & Flood**
In-scope entities	27	18	17	16	30
Eligible Own Funds (EOF)	57.1	37.6	36.5	36.5	53.5
Solvency II SCR	33.3	22.0	21.3	21.3	31.2
Coverage ratio before scenario	**171%**	**171%**	**171%**	**171%**	**172%**
Coverage ratio after scenario	**145%**	**129%**	**128%**	**147%**	**136%**
Possible regulatory breaches					
No. firms breaching SCR	3				7
Average coverage (those in breach)	*88%*				*84%*
No. syndicates with net loss >35% SCR		7	8	1	1
Average net loss as % of SCR (where > 35% SCR)		*46%*	*60%*	*36%*	*44%*

(a) For in-scope entities only, i.e. entities for whom the impact is deemed material based on the primary scenario under consideration
(b) Scenarios B1 through B4 include both liability stress as well as asset shock

The coverage ratios after each scenario assume and rely on a significant level of reinsurance recoveries – for example, in the UK windstorms and floods scenario, reinsurers are expected to pay almost 80% of the losses (**Tables 2** and **3**).

For international risks (scenarios B1 to B3), almost half of the expected reinsurance recoveries are from Bermuda-based reinsurers. The joint PRA–BMA exercise indicates that these firms are sufficiently capitalised, and that they significantly rely on reinsurance and specifically collateralised arrangements.

In aggregate, there was a slight increase in reinsurer concentration compared to 2017, reflecting an increase in the use of intragroup reinsurance. Third-party reinsurance remains well diversified, with the largest external reinsurance counterparty representing around 6% of expected recoveries.

5 Some submissions included multiple syndicates when underwritten by the same managing agent.
6 https://www.bankofengland.co.uk/prudential-regulation/letter/2019/insurance-stress-test-2019.

Table 2: Details of net and gross losses

All loss amounts in £bn [1:1.3 USD] (as at 31/12/2019)	Scenario A: Asset Shock	Scenario B1: Set of 3 US Hurricanes	Scenario B2: California Earthquake	Scenario B3: Japanese EQ & Tsunami	Scenario B4: UK Windstorm & Flood
Asset shock scenario impact (in-scope entities only)					
Net loss (a)	10.2	3.9	3.7	3.7	7.9
Liability scenario impact (in-scope entities only)					
Estimated market loss		139	54	23	22
Likelihood of event (industry view)		~ 1-in-100	~ 1-in-250	~ 1-in-250	~ 1-in-250
Gross loss		15.9	17.0	3.0	17.1
% of market loss		*11.4%*	*31.6%*	*13.0%*	*77.8%*
Net loss (b)		5.2	5.3	1.2	3.6
Net loss for combined scenario (a)+(b)	10.2	9.0	9.0	5.0	11.5

Table 3: Reinsurance flows for NatCat scenarios

Reliance on reinsurance	Scenario A: Asset Shock	Scenario B1: Set of 3 US Hurricanes	Scenario B2: California Earthquake	Scenario B3: Japanese EQ & Tsunami	Scenario B4: UK Windstorm & Flood
Total % of gross loss ceded:		**67%**	**69%**	**58%**	**79%**
- intra-group arrangements		*27%*	*24%*	*31%*	*30%*
- Bermudan based reinsurers		*49%*	*45%*	*51%*	*26%*
% of total collateralised		17%	15%	14%	10%

3 Assessment of natural catastrophe modelling

We highlight three areas that challenge the industry's robustness in the estimation of insured losses from natural catastrophe scenarios. The first relates to allowance for risks not captured within standard models (typically because the loss component, such as loss adjustment expenses, is not captured in the model). The second relates specifically to the allowance for secondary perils in light of recent experience (such as inland flooding following a hurricane). The third relates to data quality.

We will be using this information to focus our supervisory reviews on those firms that appear to be using optimistic assumptions, or whose submissions indicate significantly lower data quality than their peers.

We expect boards to use these findings to understand the limitations of their catastrophe models, and to ensure they are satisfied with the reasonableness of those assumptions designed to address any shortcomings.

3.1 Allowance for risks not captured within standard models

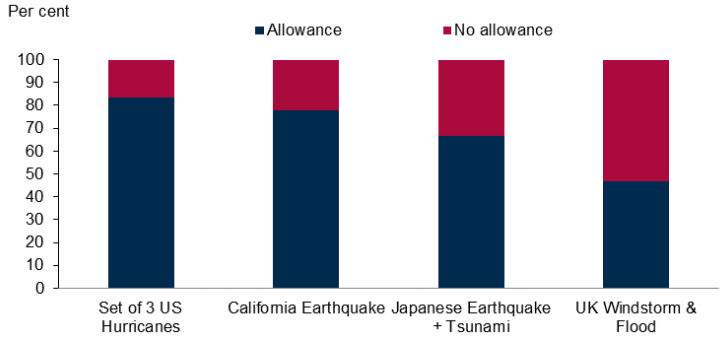
Natural catastrophe models do not always capture the full spectrum of potential losses; for example, loss adjustment expenses (LAE), losses from contingent business interruption (CBI) or losses under casualty products are often not included.

Although this is widely recognised, **Chart 1** highlights that many firms do not make any explicit allowance.

Furthermore, allowance for risks not captured within standard models is highest for peak perils (e.g. US hurricane risks), and lowest for the UK windstorm scenario. In part, this relativity may reflect that US natural catastrophe events (rather than UK windstorms) are, for many firms, the main driver when assessing capital requirements.

For firms that explicitly consider risks not captured within standard models, the loadings vary significantly (**Chart 2**) – even for portfolios

Chart 1: Percentage of firms making explicit allowance for risks not captured within standard models (LAE, CBI or casualty)(a)

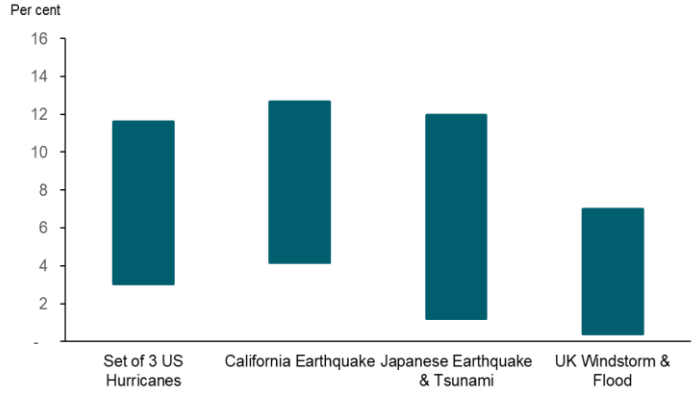


(a) Includes "in-scope" entities only, see Table 1

with a similar risk profile. This raises the question whether catastrophe model output loading is applied using solely backwards-looking methods (eg historic market allowances[7]) without appropriate consideration to forward-looking tools.[8]

While we cannot assess the extent of any implicit allowances for model loadings that firms have made and not reported, making no allowance is inappropriate when setting risk appetites or monitoring exposures, particularly in light of loss creep reported from recent events.

Chart 2: Loadings to reflect risks not captured within standard models (interquartile range)(a)



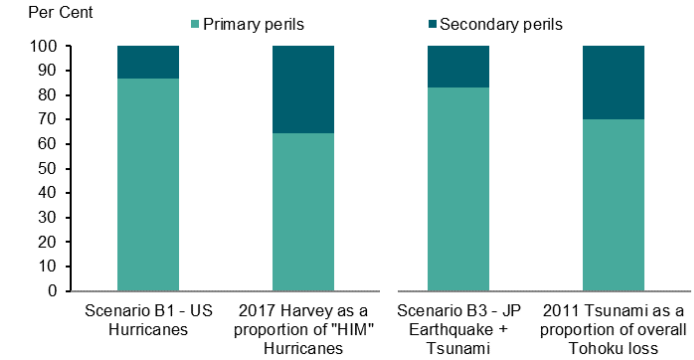
(a)For each scenario only includes firms that have made an explicit loading

3.2 Modelling of secondary perils

The natural catastrophe scenarios were designed to assess the market's ability to quantify secondary perils – specifically, we included tropically induced flooding following a US hurricane, and a tsunami following a Japanese earthquake. In recent years, such secondary perils have contributed significantly to the overall annual aggregate insured losses.[9]

In assessing the impact of each scenario, most firms relied on third-party catastrophe models. However, the ability of these models to assess secondary perils is mixed; as such, many firms complemented these models with a range of alternative methods – such as applying an allowance based on historical loss analysis, using realistic disaster scenarios or industry loss curves, or applying a frequency/severity distribution. **Chart 3** highlights the gap between the modelled allowance for secondary perils and the actual amounts based on two recent events. In each case, the actual loss from secondary perils is a higher proportion than assumed by the firms using a range of methodologies above.

Chart 3: Modelled loss from secondary perils vs. recent actual experience (% of total loss)



3.3 Data quality

As in 2017, we asked firms to provide a number of data quality metrics relating to their property exposures. Although the scenarios in each exercise were not identical, the property exposures are, in many cases, similar (particularly for the US hurricane and UK windstorm scenarios) – allowing us to compare the 2019 metrics with those in 2017. As shown in **Table 4**, the relativities between the data quality metrics are broadly similar in each exercise – ie geocoded and occupancy data is more complete than the other metrics.

However, we also observe a drop in the level of completeness in the geocoding data between the two stress tests. It is unclear whether this is due to a change in reporting, change in definition (i.e. firms increasing their expectations as to what they classify as geocoded data), or whether this is an actual deterioration in geocoding accuracy. This will be an area that the PRA will investigate further during the planned exposure management reviews.

7 From interviews we conducted, those typically range from 2-10%.

8 ABI, 2014: Non-modelled risks: a guide to more complete catastrophe risk assessment for reinsurers. Available at: https://www.abi.org.uk/globalassets/sitecore/files/documents/publications/public/2014/prudential-regulation/nonmodelled-risks-a-guide-to-more-complete-catastrophe-risk-assessment-for-reinsurers.pdf.

9 Swiss Re, 2019: https://www.swissre.com/risk-knowledge/mitigating-climate-risk/natcat-2019/secondary-perils-not-so-secondary.html.

Table 4: Data quality summary comparing the 2017 vs. 2019 stress tests returns for similar peril/territories

	% sum insured where known				
Scenario	**Geo-coded**	**Contruction type**	**Occupancy type**	**Year Built**	**Storeys**
US Hurricane					
2017 GIST scenario	98%	79%	94%	65%	60%
2019 GIST scenario	90%	82%	93%	64%	57%
EU Windstorm (2017)	96%	40%	91%	38%	21%
UK Windstorm (2019)	84%	49%	91%	46%	25%

4 Other findings

4.1 Operational resilience – reliance on outsourced providers

As in 2017, this year's stress test again highlighted that where the industry is using external claims adjustors to deal with post-loss events; this is concentrated in a couple of firms – particularly in the event of UK flood or windstorms events. Firms should consider this dynamic within their operational resilience frameworks.

4.2 Reserve deterioration

For the reserve deterioration scenario, firms were asked to estimate the impact of an increase in claims inflation of 2% per annum. For many firms, the implied aggregate net losses are comparable to those from their NatCat scenarios. This illustrates the extent to which unexpected claims inflation, even at relatively low levels, can lead to a significant impact to the balance sheet of insurers writing long-tailed lines of business. Firms should ensure that they consider the impacts of potential future inflation as part of their stress testing.

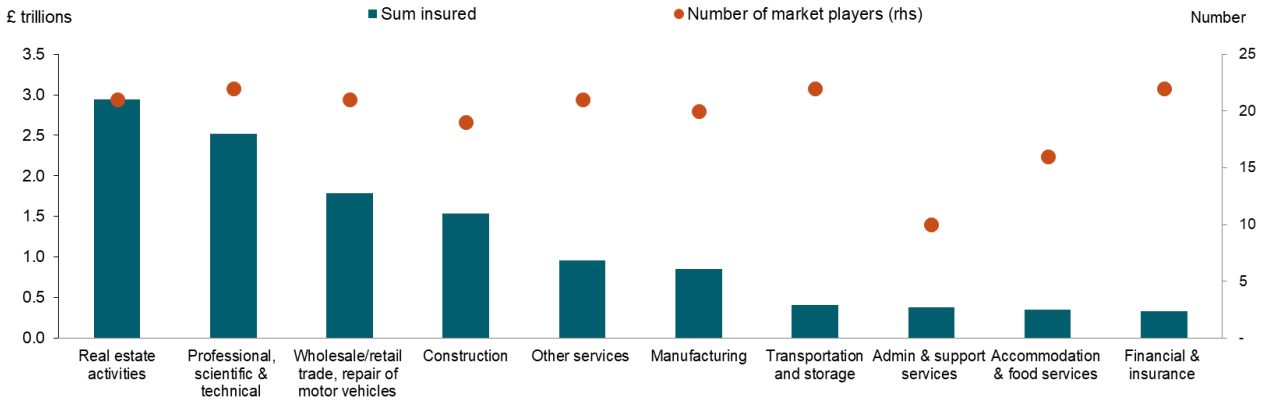
5 Exploratory scenarios (excluding climate)

5.1 Sectoral information for commercial business

Firms were requested to provide exposure data classified by product and industry. This was largely the same request as in 2017, so it was disappointing that progress has been limited. For example, a quarter of firms were unable to allocate more than 25% of their worldwide business to a specific sector. Furthermore, when asked to provide details of their own sector classification, around half simply used the standard high-level sectors in our specification, and many others classified exposures at an even higher level. This illustrates that, for many firms, the ability to extract and aggregate sector exposures is still in its infancy.
Where firms did provide the necessary data, differences between firms continues to highlight a lack of consistency, particularly in how sum insured is measured. We intend to engage with the industry later this year to see how we can improve our instructions as well as facilitate consistency in firms' responses.

Where firms were able to allocate their exposure to industry sectors, the aggregate exposure data illustrates how UK general insurers support risk transfer in the UK economy. Total commercial business insured in the UK is c.£14.2 trillion across 22 sectors of the economy with at least 10 UK insurers supporting each of the 10 largest sectors, suggesting that concentration risk within any one sector is low.

Chart 4: Total sum insured by industrial sector



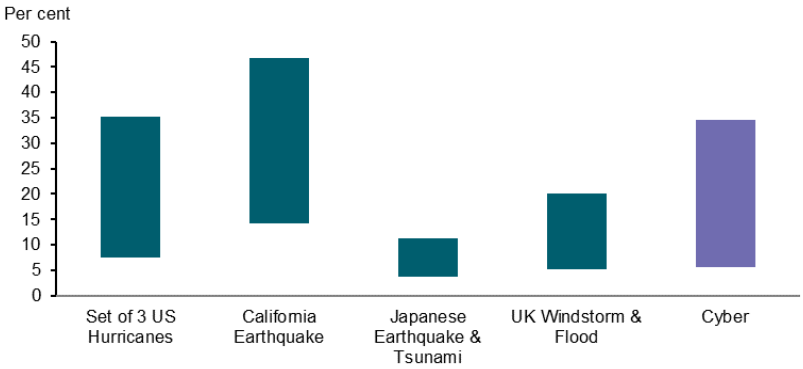
5.2 Cyber underwriting scenario

The cyber scenario was exploratory by design and allowed us to gain insight into the industry's sophistication and the different approaches to estimate sources of loss given a specific cyber event.

The implied losses from this scenario were, for many firms, comparable with the losses from their NatCat events – illustrating the increasing materiality of this risk.

In aggregate, around 50% of losses are expected to be mitigated through reinsurance. The scenario did not consider whether or not reinsurance would respond as anticipated in stress.

Chart 5: Ratio of Net losses to Eligible Own Funds (EOF) at 31/12/2018: interquartile range(a)



(a) For "in-scope" entities only

The exercise has reinforced our previous concerns on the ability of some firms to assess and manage cyber exposures.[10] There was material divergence in expertise, data, models and parametrisation in the estimation of both 'affirmative' and 'non-affirmative' cyber claims. In particular, the differences in materiality of non-affirmative cyber impact across firms suggested a patchy ability to assess such losses.

Results are indicative of differences in firms' perceptions of risk, illustrated by divergence in traditional products deemed exposed to the event: five out of 20 firms attributed majority of loss to property covers, while nine judged that the cost would mainly come from Errors & Omissions (E&O) and Directors & Officers (D&O) policies.

There was also a variation in approaches to loss assessment: i.e. applying fixed cost per policy or percentage of limits (ranging from 50% to 100%) for E&O and D&O claims.

Chart 6: Non-affirmative cyber losses product breakdown(a)

(a) Other classes included: credit and surety, legal, political risk and unallocated losses

[10] https://www.bankofengland.co.uk/prudential-regulation/letter/2019/cyber-underwriting-risk-follow-up-survey-results.

For stand-alone cyber, the submissions highlighted significant differences in methodologies and parameters:

- A wide range of lost revenue percentages (from just 11% to 100%) was used to assess business interruption (BI) costs, the largest loss category across most firms.
- The allowance for other (non-BI) costs ranged from zero to 75%. The approaches for assessing non-BI losses also varied: modelled as percentage of limits, cost per device or share of overall losses.

With gross losses running in multiples of annual stand-alone cyber premiums, this underlines the immaturity of available models, with potential links to capital adequacy.

ANNEX 3: Life insurers – IST 2019 feedback

1 Introduction

This is the first time since the introduction of Solvency II that the PRA has asked life insurance firms to participate in a stress testing exercise. The exercise was voluntary, and we invited 17 UK regulated life entities across 12 groups to complete the exercise. We chose these firms as they had large annuity exposures within matching adjustment (MA) portfolios.

As this was the first stress test under the Solvency II regime, we anticipated that there would be learning points for firms and the PRA after completing such an exercise. We outline these learnings below and they will inform the design and specification for the next life stress test.

We recognise the significant time and effort that firms put into completing the stress test, and we note that we asked firms to complete the exercise on a 'best endeavours' basis.

Most firms, as instructed, carried out a bottom-up calculation for more straightforward elements of their stressed balance sheet, rather than relying on simplifications via proxy models. For more complex variables, approaches included a number of approximations and other simplifications, which affected the evaluation of the most material balance sheet items under each of the stressed scenarios. Furthermore, our instructions permitted approximations and simplifications, but variations in the quality of supporting evidence and validation meant that it has not been possible to assess whether comparable firms are taking broadly consistent approaches.

We will engage with the industry during 2020/21, ahead of our next test planned for 2022, to discuss the areas that we have identified as needing further development (see below).

2 Learnings for firms

2.1 High impact areas

The **high impact areas** where firms made significant approximations are as follows:

a. **Recalculation of the MA in stress:** the post-stress best estimate liability (BEL) calculation relies on an accurate recalculation of post-stress MA. A number of firms did not fully assess the matching position of the MA portfolio post-stress, despite this being explicit in the instructions and a PRA requirement within capital models. This led to some uncertainty in the level of MA benefit claimed in stress.

b. **Recalculation of the Solvency Capital Requirements (SCR) in stress:** our instructions reflected the complexity for internal model firms in calculating the SCR after an extreme scenario, and outlined acceptable simplifications. A small number of firms followed this approach, and a number of other internal model firms attempted a more sophisticated calculation. However, in the majority of cases firms relied on pre-stress calibrations of the SCR model, without considering whether this remained appropriate following an extreme stress.

c. **Recalculation of the risk margin in stress**: as the risk margin calculation uses the post-stress SCR directly, weaknesses in the SCR calculation flow through to the risk margin calculation, and the impact is exacerbated in stress where interest rates fall and longevity improves.

d. **Recalculation of transitional measures on technical provisions (TMTP) in stress:** TMTP will become an increasingly material component of the balance sheet after each stress. Unfortunately, some firms applied approximations with limited/no validation, and no firm considered whether the level of TMTP would be 'affordable' given its projected business model over the transition period.

2.2 Limitations in methods due to approximations and simplifications

In aggregate, these components can potentially significantly affect the evaluation of the required technical provisions and capital requirements in stress and hence the estimated solvency position. Given our findings, boards will need to consider further their approaches to setting risk appetites and how these should take into account the limitations inherent in the approximations and simplifications applied.

2.3 Data limitations

For some firms, some inconsistencies in asset data were identified across different data submissions. Although these were ultimately reconciled, this came at the expense of additional time and cost for the PRA and firms. For firms, this indicates the need for further work on data quality and controls to support concurrent stress testing; and for the PRA this has highlighted where the design specification can be improved to avoid any overlaps or inconsistencies.

2.4 Counterparty risk management

This exercise identified gaps in the risks that firms considered when assessing reinsurance counterparties in stress. This includes:

a. whether the increase in required collateral following a credit/longevity event would cause reinsurance counterparties any financial difficulty (including the risk that these counterparties would be required to post additional collateral to multiple counterparties in a stressed environment);

b. the valuation of the counterparty default adjustment on the balance sheet in stress;

c. the ability of counterparties to deal with a further stress when considering post-stress counterparty capital requirements.

Where firms did provide information, they tended to argue that the impact to their reinsurers would be limited, without providing justification beyond high-level qualitative argumentation as to why this would be the case.

3 Learnings for the PRA in structuring and specifying stress tests

3.1 Stresses to MA portfolios

The impact of the stress scenarios on the overall level of fundamental spread seen in MA portfolios was lower than expected, and we saw low levels of external rebalancing as a result. The PRA weakened the credit downgrade stress specified in scenario A1 in response to industry feedback. Furthermore, the long term average spread floor within the fundamental spread calculation meant that the stress impact of B2 was minimal. In future stress exercises, the PRA will consider whether to issue a stressed transition matrix and stressed fundamental spread tables.

3.2 Expectations around model validation

The expectation gap between firms and the PRA around the level of validation required to support different approaches highlights the need for more specific instructions; for example, which aspects of the SCR calculation should be followed in stress (e.g. MA matching tests). In addition, future exercises will ask firms to submit a report explaining key aspects of the submission, placing more onus on the need for validation and justification to accompany the use of any approximations.

ANNEX 4: Climate change scenario feedback

1 Introduction

Results from the exploratory climate scenario revealed significant gaps in the industry's capability to evaluate climate-related scenarios. These gaps are particularly acute in relation to the evaluation of climate impacts on investments, so these will need addressing before we are able to share quantitative market information. To share these results now would show an aggregation of disparate estimates that largely reflect differences in capabilities, rather than an indication of potential impacts relating to climate risk.

This section instead focuses on six qualitative findings: the first of these are key learnings on the market's ability to assess climate risk, whereas the final three are observations that reflect learnings for future climate design and specification, and will inform development of the Bank of England's forthcoming climate biennial exploratory scenario (BES).

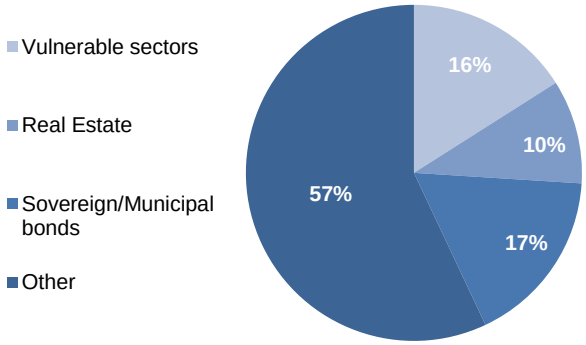
2 Market capabilities

2.1 There are significant gaps in data, tools, processes and expertise

The following are examples of areas where firms struggled in translating the high-level scenario specification into potential financial impacts:

- The ability to allocate individual counterparties to sectors/level of vulnerability is highly variable across the industry (**Chart 7**).
- Few firms have the necessary tools that are able to assess the impact on alternative/illiquid assets.
- Few investment frameworks are able to estimate changes to downside risk (Value at Risk, VaR) (**Chart 8**).
- Firms found it challenging to modify existing tools (eg catastrophe models) to assess physical asset exposure to forward-looking physical climate change risk.
- Firms' ability to assess perils that currently are perceived as having a low capital impact (e.g. UK freeze or subsidence), is mixed (**Chart 9**).

Chart 7: Allocation of investments to sectors (a)



(a) 'Vulnerable sectors' refer to the fuel extraction, energy, power, transport and agriculture sectors.

Chart 8: Ability to calculate investment VaR

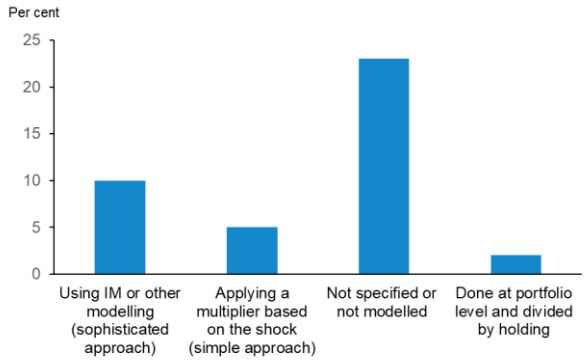
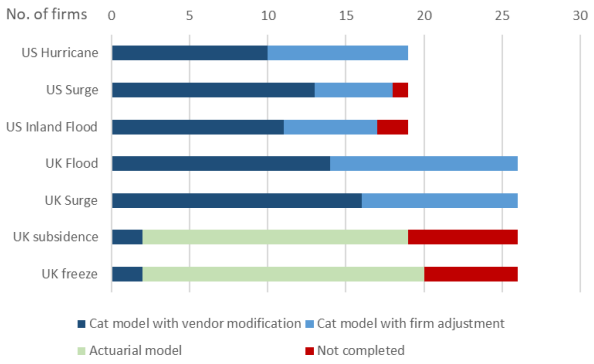


Chart 9: Assessment of second order perils



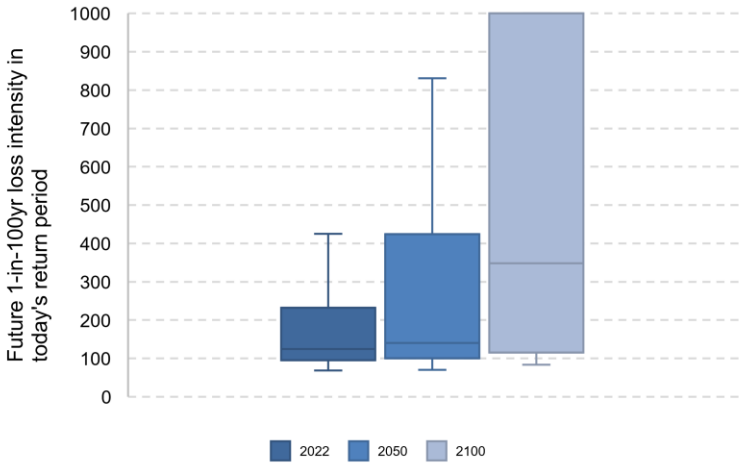
2.2 Current model design/specifications constrain scenario outcomes

Current models will need to be significantly enhanced if they are to reflect the increased complexity of the longer timeframe and the interrelated impacts required under a climate scenario.

For example, current natural catastrophe models do not always provide for alternative catalogues reflecting future climatic states, nor do they allow for sensitivity analysis that can reflect cascading events such as the impact of future government efforts to enhance or maintain flood protections to mitigate the severity of physical damage.

Chart 10 illustrates how the expected 1-in-100 year loss could change under the three scenarios. The significant range in 2100 in part illustrates limited commonality in estimating how climatic changes may impact insured losses. (Note: the graph does not depict the full range of future climatic outcomes – some of which could result to an upside in risk for some geographies. Instead, it illustrates a set of plausible climatic outcomes per the IST design, and demonstrates significant sensitivity of catastrophe models to the underlying hazard assumptions.)

Chart 10: Estimates of the 1-in-100 year US Hurricane modelled loss when applying the IST 2019 deterministic climate shocks(a)



(a) Under an extreme physical climate change scenario, a 1-in-100 year loss may exceed today's 1-in-1,000 year loss.

2.3 Climate risk management is not yet sufficiently embedded

Based on submissions and subsequent correspondence, it was evident that within many firms, this climate exercise was carried out by one team (eg risk department) with very limited input (if any) from other parts of the business. Cross-functional engagement will be essential if firms are to coherently assess the longer-term impacts under each of the scenarios, as it will be necessary to go beyond easily accessible data that is of limited use.

Furthermore, the quality of the returns supplied for part 2 of the 2019 IST were, for many firms, poorer than that supplied for the Supervisory Statement (SS) 3/19: 'Enhancing banks' and insurers' approaches to managing the financial risks from climate change'.[11] This reinforces our concern that climate-related work is not uniformly embedded across firms, and intra-firm communication channels are yet to be established (e.g. between actuarial, compliance and risk teams and across levels of seniority).

3 Observations for future climate scenario design and specification

3.1 Top-down design choices overly influence results

As this was the first climate stress test, we provided a significant level of guidance and specification to assist firms in assessing the potential financial impacts. Nonetheless, due to the desire to provide input assumptions that could be relatively easily incorporated by firms, the results of the exercise were overly sensitive to a number of high-level design choices, such as:

[11] April 2019: https://www.bankofengland.co.uk/prudential-regulation/publication/2019/enhancing-banks-and-insurers-approaches-to-managing-the-financial-risks-from-climate-change-ss.

i. The corporate bond stress was only 15% of the equity stress; this was a broad-brush assumption.

ii. Alternative assets were treated in a way which meant they did not fall neatly into the prescribed categories, and therefore did not always receive a stress.

iii. Other assets outside the most carbon-intensive sectors were given a blanket stress, along with the knock-on impacts of physical risk to these sectors.

3.2 More detailed reporting is needed to aid comparability/compare judgements

The quantitative impacts are significantly influenced by firms' ability to identify and allocate investments to vulnerable sectors.

The level of reporting did not enable us to assess the different judgements made by firms, and hence whether discrepancies in judgement were due to the use of different data classifications, differences in parameter choices (particularly when some firms assumed a manual override) or whether they reflect actual differences in risk profile.

3.3 Benefit of having a second round of submissions

While industry roundtables held during the May 2019 'request for technical input' phase provided a useful forum for initial discussions/queries, most of the challenges and questions only emerged when insurers started to assess and quantify the implications on their portfolio. Consequently, and given the relative immaturity of analysis in this area, there is potential value in having a second round of submissions to address any sector-wide responses, as well as enabling common difficulties to be addressed.