



Institute of Actuaries of Australia

3 March 2011

Professor Ross Garnaut
Garnaut Climate Change Review – Update 2011
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By email: garnautreview@climatechange.gov.au

Dear Professor Garnaut

Submission to the Garnaut Climate Change Review – Update 2011

I am pleased to enclose The Institute of Actuaries of Australia's submission to the Garnaut Climate Change Review – Update 2011.

The Institute is the sole professional body for actuaries in Australia, providing expert and ethical comment on public policy issues wherever there is uncertainty of future financial outcomes. It represents the interests of over 3,800 members, including more than 2,000 actuaries. Our members have had significant involvement in the development of insurance regulation, financial reporting, risk management and related practices in Australia and in Asia over many years. The Institute also has an Energy and Environment policy, which is one of four main areas of proactive focus going forward. Our members are also active in this area.

Our submission focuses on the potential impact of climate change on the costs of insurance provided by the Australian private insurance market in relation to weather-related claims. The key findings are summarised in the short Executive Summary in the first pages of the submission. In this submission we have not discussed options for responding to the potential increase in costs, and in particular the viability of alternative pooling arrangements.

The Institute would be pleased to discuss the issues raised in this paper or to respond to specific further questions to assist the Garnaut Review in the course of its work. In this regard, please do not hesitate to contact our Chief Executive, Melinda Howes on (02) 9239 6106.

We would be happy to elaborate on aspects of the submission, if required.

Yours sincerely

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Institute of Actuaries of Australia

Submission to

Garnaut Climate Change Review

Update 2011

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Part I Executive Summary

Introduction

This submission focuses on the potential impact of climate change on the costs of insurance provided by the Australian private insurance market in relation to weather-related claims.

Our starting point has been to examine the current costs of weather-related claims and the associated premium levels. We have not attempted to draw any conclusions or link between climate change and its potential impact on the frequency and severity of various weather-related events. Hence we have used scenario analysis to provide an indication of the potential impact of climate change on insurance costs. This analysis quantifies the extra cost which would emerge from a doubling of the annual average costs of the pure claims component arising from only weather-related events.

We have also considered the response of insurers to the recent increase in costs arising from weather-related events. We have only considered the impact on general insurance and in particular the insurance of property. We have not considered the impact on life, disability or health insurance.

Current Cost of Weather-related Claims

The estimation of the cost of weather-related claims is very challenging. This is primarily because large events occur infrequently, and hence a very long period of time series data is needed to estimate the cost accurately. Unfortunately this data does not exist. The approach underlying the figures presented in this submission is high level and involves judgement.

The Australian private general insurance market collects around \$28 billion of premiums per annum with around \$16 billion of this amount coming from insurance classes most impacted by weather-related claims (Home and Commercial Property, Marine and, to a lesser extent, Motor). We estimate that around 30% of the premium for these classes or almost \$5 billion is associated with weather-related claims.

We further estimate the average annual weather-related claims costs for the weather impacted classes listed above are around \$3 billion per annum. There is significant year to year variability in this aggregate level of cost.

The average claims cost varies materially from property to property, depending primarily on location. For example, in the lowest risk areas the weather-related claims cost for Home insurance would be around \$50 per home, compared to more than \$3,000 per home for the properties most exposed to riverine flood (Source: IAA paper, "The Insurance of Flood Risks", 2008). The high claims cost for the most exposed worst risks creates issues of affordability since these costs flow through to individual household premiums.

Gaps in Private Insurance Market

The estimate of \$3 billion reflects the cost of claims paid by private insurers. The full economic cost of weather-related events to Australia is significantly higher since not

all risks or costs are insured. There are in fact a range of gaps in insurance coverage which, when taken together, are significant.

The private insurance market provides individuals, businesses and government entities with cover against the impact of weather-related events on assets and profits. The following gaps in coverage provided are noteworthy:

- **non-insurance:** where consumers, businesses or government do not purchase insurance
- **under insurance:** where the amount of insurance purchased is insufficient
- **self insurance:** similar to non-insurance, but typically reflects a more specific intention to retain the risk and fund it by other means
- **coverage restrictions:** where there are gaps in the cover provided by insurers. For example, a number of insurers do not cover riverine flood or storm surge

The proportion of economic losses from weather-related events will vary substantially by type of weather peril and by event, but on average the insured proportion of the total direct financial losses from Australian weather-related events is estimated to be around 50%.

In addition we note that climate change may present the community with a number of new risks (for example reductions in the value of riverine and coastal land) for which no insurance is currently available.

Impact of Climate Change on Insured Costs – Scenario Analysis

If the privately insured claim cost due to weather-related claims were to double as a result of climate change, this would represent an additional average annual claims cost of \$3 billion. With such an increase, it is also likely that the volatility from individual severe weather events and from annual aggregate claims costs would increase significantly.

All else being equal, the premiums charged by insurers for an additional \$3 billion of claims cost would have to increase by more than \$3 billion, because the claims cost is not the only cost to which insurers are subject. They are also subject to:

- the costs of managing the claims and for some other relevant management costs, and
- the additional cost of capital and reinsurance that would be needed to support the increased volatility of the business resulting from the higher level of weather-related claims.

This means that the total increase in premiums to consumers would be in the vicinity of \$4.5 billion.

It is noteworthy that a doubling of the underlying expected cost would exacerbate the issue of affordability for some individual insureds, with the claims cost for the highest risk homes increasing to more than \$6,000 per annum causing an increase in individual premiums of an amount even greater than this.

Response of Insurers to Recent Increases in Weather-related Claims

Weather-related claims costs incurred by insurers were low between 2001 and 2006. In the last four years we have observed an increased frequency of these claims. The last 12 months' experience has been particularly heavy, including the Melbourne and Perth hailstorms, the Queensland floods and Cyclone Yasi, amongst other events.

Insurers continually update their catastrophe modelling and pricing models as new experience emerges. Most insurers have increased their assessment of weather claims costs following the recent years' experience. Home premium rates have increased by more than general levels of inflation in recent years, and weather-related claims are one of the reasons for the increases. In contrast, commercial property premiums have not increased on average in the last two years. This does not mean that the cost of claims has not risen; rather competitive market conditions were driving prices down such that it is likely that premiums are not sufficient to cover insurers' costs. As a result it is plausible these premiums will increase in the medium term.

In general and based on improved data and analysis, insurers' pricing approaches have been becoming more granular (i.e. prices vary across risks to a greater extent, with fewer cross subsidies between the best risks and the worst risks). This is another driver of premiums becoming unaffordable for some risks.

Limitations

Due to limitations on data, the short time period for which it is available, and the inherent variability in weather-related claims costs, the estimates of cost provided in this submission are uncertain. There is no guarantee they will prove to be correct. However, we believe they are a reasonable indication of the order of magnitude of the cost.

The claims cost estimates are derived from various sources, including data from APRA and Insurance Statistics of Australia (ISA). The ISA data does not represent 100% of the insurance market and we adjusted for this, although such adjustments are necessarily approximate.

Part II Detailed Findings

1. Introduction

This submission is focused on the potential impact of climate change on the weather-related claims costs of Australian private insurers.

Our approach has involved:

- considering the extent of weather-related claims covered by the private insurers, including gaps in that coverage (Section 2)
- quantifying the current cost of weather-related claims being paid by the private insurance market (Section 3)
- considering the response of insurers to the recent increase in costs (Section 4)
- recognising the potential for climate change to impact frequency and severity of weather-related claims, we have used scenario analysis to quantify potential impact of a doubling in weather-related costs.

We have not considered:

- the link between climate change and the increase in frequency/severity of weather-related events
- potential future shifts in population, demographics and building developments which may materially change the exposure to risk of weather-related claims
- the impact of climate change on life, disability or health insurance costs – this study is limited to general insurance, and in particular the losses to assets, particularly property, and profits
- the impact that any government pooling (for example a national disaster fund) or regulation may have on costs.

All amounts in this submission are inflation adjusted to be in today's values.

2. Private Insurance Market

The private insurance market in Australia is a key component in building the resilience of the Australian community and economy to weather perils. The key role of the insurance industry is the pooling of risks and subsequent payment of claims to indemnify individuals, businesses and government. The private insurance industry is also active in encouraging risk mitigation, such as improvement of building codes and disaster recovery plans.

However, in every weather-related claim, the insurance industry will only cover a proportion of the total economic losses and this proportion varies materially by type of weather peril and from event to event (refer Table 2.1). The reasons for this are explored in Section 2.1. On average it has been estimated that the insured proportion of the total direct financial losses from Australian weather-related events is around 50%.

Table 2.1 – Example of cost of total direct financial loss and insured loss for certain weather-related disaster events in Australia 1999 to 2009

Date	Event	Total Direct Financial Loss \$ millions	Insured Loss \$ millions	Insured %
April 1999	Sydney Hailstorm	2,120	1,700	80%
March 2006	Tropical Cyclone Larry	1,500	540	36%
June 2007	Hunter Valley & Newcastle Storm/Floods	2,145	1,480	69%
February 2009	Victorian Bushfires "Black Saturday"	1,444	1,070	74%

Source: Data from Swiss Re Sigma reports, Insurance Council of Australia. The insured loss amounts exclude claims paid by non-APRA-regulated insurers or insurers that are not part of the Insurance Council database.

Insurance Gaps

Recent events have highlighted the problems faced by the community in the wake of weather-related events. Insurance plays a crucial role in shielding the community from the effects of such perils; however it is not able to be a comprehensive safeguard for all losses suffered, due to gaps in insurance coverage. Gaps arise from:

- Product gaps, including
 - Gaps in the range of insurance products available, or
 - Lack of availability of products to all potential customers
 - Lack of coverage within existing products
- Voluntary under insurance or non-insurance.
- Self insurance (typically reflects a specific intention to retain the risk and fund it by some means other than insurance).

2.2 *Product Gaps*

Gaps in the range of insurance products

There are risks to which the community is exposed for which no insurance product is available. This gap can be filled by the creation of new forms of insurance. Depending on the specific risk in question, this may or may not be feasible.

Climate change may induce demand for new forms of insurance. In particular, there may be demand for insurance products offering coverage for climate change solutions.

Lack of product availability to all potential customers

Whilst insurance products may be available to most consumers, there may be certain consumers for whom insurance is not available, or is prohibitively expensive. Of note is the insurance of homes with a high propensity to flood. If a home is expected to flood relatively frequently, the cost of insuring the home against flood damage may be prohibitive. Insurers may offer a product excluding the damage for flood events, but this does not help the consumer to offset their flood risk. On the basis that climate change may cause an increase in the frequency or severity of weather events, there may be more consumers affected in this manner.

Lack of Coverage within existing products

Insurance products will be specifically designed to ensure that insureds retain a proportion of any potential claim, - for example many products have a deductible amount that is paid by the insured in the event of a claim, before the insurance cover responds. This is important to keep the alignment of interests between the insured and insurer, so that the insured retains an interest in preventing claims events from occurring.

In other cases, there are a variety of insurance products in the current competitive marketplace, often offering different coverage. Whilst it may be seen as desirable to offer a range of products to suit the market's needs, this can also inadvertently create issues of under insurance or non-insurance. Based on recent events, flood appears to be a good example of this.

2.3 *Voluntary Under Insurance and Non-Insurance*

A major cause of insurance gaps is voluntary under insurance or non-insurance. We define this as the situation where an appropriate product to offset the risk exists within the insurance marketplace, but is not purchased by the consumer or not enough cover is purchased. This places a cost burden upon the consumer in question and potentially the state when a severe weather event occurs.

A key driver of this behaviour is the cost of insurance. Most consumers are cost conscious to some degree and the natural tension between the cost and level of protection purchased drives a tendency for consumers to under insure.

The cost of insurance products is compounded by the effect of taxes and levies. We note that there have been a number of studies on the effect of taxation and levies on insurance products on insurance uptake. We generally support the conclusions of such studies, which suggest that insurance uptake would increase if such imposts on insurance premiums were removed or reduced. The Institute has discussed this matter at length in its 2010 submission to the Victorian Fire Services Funding Review which can be found at [FSF Review Victoria](#).

Further discussion of the issues surrounding insurance gaps is contained in Appendix A.

3. Current Level of Weather-Related Claims

3.1 Insurance Classes Impacted by Weather-related Claims

For the purpose of this submission, we have focused on weather-related perils in Australia, primarily storm, bushfire, tropical cyclone and flood. The table below shows our assessment of the sensitivity of various forms of insurance cover to changes in the frequency and/or severity of weather perils arising from potential changes in climate.

In many cases, insurance claims experience may be impacted not just by catastrophic weather events, such as severe tropical cyclones, but by less severe changes in the environment. Our estimates relate to all weather-related damage, whether due to an event that caused a single claim or a catastrophic event causing many thousands of claims.

Importantly, there are some claims that we have excluded, as described here, as they are very difficult to estimate. In some cases, the weather can also be seen to have an indirect or contributory effect on claims cost, rather than being the direct cause of a claim. For example, it is frequently observed that the number of domestic motor vehicle claims increases materially during periods of high rainfall, particularly after dry spells, which may arise from slicker road conditions. Whilst not being a direct cause of a claim, in this case the weather conditions increase the propensity for collisions to occur. Our analysis does not make any allowance for any indirect or contributory impacts of climate change on claims cost, and is focussed on the direct costs associated with weather events.

Table 3.1 - General Insurance Products

Product	Australian GWP ¹ (\$M)	Key Perils / Outline of Cover	Weather-related Claims impact (L / M / H)
Personal lines			
Home & Contents	5,073	Burglary, Fire, Other Natural Disasters, Vandalism, Damage (from fallen trees or motor vehicles), Bursting or leaking of water	High (location specific)
Domestic Motor Vehicle	6,512	Accidents, Theft, Third Party property damage, Other damage (e.g. vandalism, natural disasters)	Low/Medium (location specific)
CTP Motor Vehicle	2,609	Injury from motor vehicle accidents	Negligible
Travel	531	Bad Weather or Aircraft complications. Theft, loss or damage to luggage	Low
Consumer Credit	325	Injury / Unemployment	Negligible
Mortgage	1,091	Borrower's default	Low (risk specific)
Other	668	All Guarantees (e.g. Fidelity guarantee), Trade credit, Extended warranty, Kidnap & Ransom, Contingency	Negligible
Commercial lines			
Fire & ISR (Commercial Property)	3,246	Fire, Other Natural disasters, Material damage & consequential losses, Theft, business interruption	High (location specific)
<i>Including:</i>			
Farm and Crop		Theft, Machinery breakdowns, Fire, Other natural disasters	Medium
Construction & Engineering		Construction liability, construction material damage & equipment failure	Low (location specific)
Commercial Motor	1,700	Accidents, Theft, other damage (e.g.	Low

Vehicle		vandalism, natural disasters), Third party property damage	
Marine & Aviation	671	War, Accidents, Damage. Theft of Vehicle, Loss or damage of cargo, Damage to other property and vehicles	Medium
Public & Product Liability	2,024	Damage to third parties and recall of items	Low
Employer's Liability / Worker's Compensation	1,205	Injury in the workplace	Low
Professional Indemnity	1,329	Act, error or omission in service or advice	Low
Other Accident	1020	e.g. Non-ISR Engineering, Guarantee, Sickness & Accident, Miscellaneous (e.g. loss of money)	Low
<i>Including:</i> Livestock		Sickness/Death	Medium
Total direct business	28,002		

¹ Gross Written Premium. The figures represent the 12 months to 30 June 2010, taken from industry statistics published by APRA: <http://www.apra.gov.au/Statistics/GI-Half-Yearly-Statistics.cfm>

For most classes of business, weather-related claims have only a negligible or low impact. The classes impacted to the greatest extent are Home, Fire & ISR (Industrial Special Risks) and Motor and Marine, representing total gross written premiums of around \$16 billion out of total gross written premiums in Australia, (derived from APRA statistics) of \$28 billion per annum. We estimate that around 30% of this premium of \$16 billion is associated with weather-related claims.

More Detailed Analysis

We have undertaken more detailed analysis of the Home, Commercial Property and Motor classes. Table 3.2, Table 3.3 and Table 3.4 show our estimate of the gross average annual claims cost of weather-related claims for Home, Commercial Property and Motor respectively. We show the cost as a percentage of the 2009/10 industry gross premium, derived from APRA statistics. For Home, we also show the indicative range of costs per policy for a standard house in a low risk area and in a high risk area.

The average gross annual costs are estimates and are intended to be indicative of the order of magnitude of costs for each peril. The estimates were selected using judgement with reference to:

- The experience of some individual insurers
- Cyclone modelling data (i.e. synthetic data)
- Data of catastrophes over 44 years collected by the Insurance Council of Australia
- Data provided by Insurance Statistics Australia of the experience since 2003, covering up to 90% of insurers (fewer in some years).

It is worth noting that there is significant variability around the cost in any particular year, depending on the prevailing weather conditions in the year, which will be impacted by both short and long term weather patterns.

Note that some Commercial insurance is placed directly with overseas insurers, such as Lloyd's of London. The ISA data and our estimate relates only to APRA regulated insurers

Table 3.2– Impact of gross cost of weather-related claims on Home

Peril	Average Annual Cost	% Premium ³	Average Cost Per Home ⁴	Cost Per Home ⁴ in Low Risk Areas	Average Cost per Home ⁴ in High Risk Areas
	\$m	\$m	\$	\$	\$
Non weather related costs	1,420	28%	218		
Storm ¹	940	19%	145	40	200
Bushfire	120	2%	18	-	300
Cyclone	270	5%	42	-	3,000
Riverine Flood ²	370	7%	57	-	3,000
Total (weather related)	1,700	34%	262		
Total Claims Costs	3,120	62%			
Expenses/Levies /Other	1,953	38%			
Total Premium	5,073	100%			

Notes:

1. Includes flash flood, hail, windstorm, lightning, rainwater
2. Assumes cover provided by all insurers
3. Based on industry premium levels in 2009/10 including Fire Services Levy
4. Buildings and Contents combined

Table 3.3– Impact of gross cost of weather-related claims on Commercial Property

Peril	Average Annual Cost	% Premium ³
	\$m	\$m
Non weather related costs	1,370	42%
Storm ¹	450	14%
Bushfire	70	2%
Cyclone	150	5%
Riverine Flood ²	200	6%
Total (weather related)	870	27%
Total Claims Costs	2,240	69%
Expenses/Levies/Other	1,006	31%
Total Premium	3,246	100%

Notes:

1. Includes flash flood, hail, windstorm, lightning, rainwater
2. Assumes cover provided by all insurers
3. Based on industry premium levels in 2009/10, incl Fire Services Levy

Please note we have not shown the average cost per policy for commercial property, as the significant range of sums insured per policy means little can be inferred from this sort of measure.

Table 3.4– Impact of gross cost of weather-related claims on Motor (Commercial and Private)

Peril	Average Annual Cost	% Premium²	Average Cost Per Vehicle
	\$m	\$m	\$
Non weather related costs	5,333	65%	533
Storm ¹	310	4%	31
Other catastrophes	60	0.7%	6
Total (weather related)	370	5%	37
Total Claims Costs	5,703	69%	
Expenses/Levies/Other	2,509	31%	
Total Premium	8,212	100%	

Notes:

1. Includes flash flood, hail, windstorm, lightening, rainwater
2. Based on industry premium levels in 2009/10

We estimate the average annual weather-related claim costs to be \$1.7 billion for Home, \$0.9 billion for Commercial Property and \$0.4 billion for Motor, giving around \$2.9 billion in total. Given the uncertainties and noting this figure is an estimate we have referred to a claims cost of \$3 billion elsewhere in this submission.

Relative to the premiums charged, the class most impacted by weather-related claims is Home. We estimate that for a standard house in the highest risk areas, the premium loading for riverine flood would be \$3,000 or more due to the claims cost. The highest risk properties may also have significant premium loadings for cyclone and bushfire claims. Storm claims costs tend to be more broadly spread across policyholders.

4. Scenario Analysis

We have used scenario analysis to quantify the extra cost which would emerge from a 100% increase in weather-related claims. We have considered the following scenario:

If the annual average cost of weather-related events were to double, what is the impact on premiums?

As discussed in Section 3 above, we have estimated an average annual cost of weather-related claims of \$3 billion. A doubling of this cost indicates an additional average annual pure claims cost of \$3 billion.

Under this scenario, the premium charged by insurers would increase by more than the extra \$3 billion claims cost. As highlighted in Appendix B, the premium charged by an insurer needs to cover:

- the expected average annual cost arising from both attritional and weather-related claims, plus
- the insurer's expenses, which include commissions, claims management and overheads, plus
- an allowance for the cost of capital, plus
- the net cost of reinsurance, reflecting the difference between premiums paid by the insurer for reinsurance and the expected reinsurance recoveries.

Thus, an extra \$3 billion of weather-related claims cost is only one portion of the total cost increase. Emerging from these additional claim costs, there will be:

- claims handling expenses associated with these extra claims (usually calculated as a % of claims costs)
- an additional cost of capital. This could increase disproportionately, if the volatility of the overall claims distribution is perceived to increase, thus increasing the cost of capital and hence the profit loading
- an additional allowance for the net cost of reinsurance, which captures the difference between the premium paid by the insurer for reinsurance and the expected recoveries. This could have a magnifying effect on the costs of reinsurance. The premium paid by the insurer for reinsurance could increase due to:
 - the increased claims cost, which is factored into the reinsurer's pricing (whether that is through experience rating or exposure rating or a blend – see Appendix C for details)
 - the cost of additional reinstatements of cover
 - increased volatility for the reinsurer (which is also factored into pricing through profit loadings).
- additional taxes and levies

For Home insurance, we estimated in Section 3 that the additional claims cost associated with a 100% rise in weather-related claims to be around \$1.7 billion. This would increase the total claims cost across all perils (including non-weather) from \$3.1

billion to \$4.8 billion. If we assume the total gross claims cost as a percentage of total gross premiums remains constant at 62%, this would imply an increase in the total gross premiums from \$5.1 billion to \$7.8 billion, an increase of just over 50%.

Similarly, an increase of 100% in the weather-related claims for Commercial property would increase the total premiums from \$3.2 billion to \$4.5 billion, an increase of around 40%. For Motor, the increase in total gross premiums is smaller, from \$8.2 billion to \$8.7 billion, an increase of around 6%. The total increase across all three classes is \$4.5 billion, from \$16.5 billion to \$21.0 billion.

The relative rise in the average premium under this scenario may be different to this if the increase in weather-related claims gives rise to a change in the ratio of gross claims to gross premiums. This could easily occur, as the increase in weather-related claims could cause the overall volatility of the total claims cost to increase. As mentioned above, this may require insurers to hold additional capital and may further increase the cost of reinsurance, the cost of which would give rise to a further increase in premiums.

An additional societal problem then arises that the high risk areas, if risk rated, will bear the brunt of the increase in premiums. This exacerbates the issue of affordability for these particular areas. This may result in more gaps in insurance, as discussed earlier.

5. Response of Insurers to Recent Experience

Insurance losses due to natural events such as storms, cyclones, bushfires, and flood have increased substantially in recent years. It cannot be determined at this stage the extent to which this is a result of climate change.

It is helpful to consider separately the responses of direct insurers and reinsurers. While direct insurers and reinsurers share similar concerns with respect to the impact of climate change on large weather-related losses, their responses to changing claim costs and conditions are subject to different influences.

5.1 Primary Insurers

As a direct result of market competition and the continuing development of modelling techniques and tools, direct insurers have improved the sophistication of their technical risk pricing in recent years. The continuing evolution of IT and systems technology in recent years also now enables analysis which was previously not feasible. This enables insurers to improve the determination of the expected cost of claims for different risk cohorts, to which expenses and other allowances such as cost of capital, are added to arrive at a theoretical risk premium. This theoretical risk premium is then modified according to the insurer's objectives within the competitive environment in order to arrive at the final premium seen within the market.

Insurers are continually re-calibrating their cost models and pricing approaches for weather-related perils as new experience emerges. In recent years they have been investing more in their ability to price risks at the individual address level (rather than at a broader level such as suburbs or postcodes), drawing information from a range of catastrophe modelling and other relevant data. For instance, some insurers have historically provided flood cover on a community rated basis, but the current trend is towards more granular address based approaches, whereby the price can vary from suburb to suburb or even house to house, using available flood map data. The end result of the individual address rating model is that risk cost cross-subsidy is gradually recognised and removed; this naturally leads to large premium increases for some policies in the areas modelled as high risk.

Owing to the commercial considerations in a competitive market, the prices charged by insurers do not always represent the technical premiums, particularly over a short timeframe. A common approach adopted by insurers is to stagger any premium increases for existing and/or new policyholders over a number of years, so as to not cause abrupt and large premium increases which may result in brand damage and/or impact market share over the long term. There may also be cross subsidies between a suite of insurance products sold to the same customers e.g. between the motor, property and liability covers in a business insurance package.

In recent years, the increase in weather-related perils losses has been reflected in substantial increases in personal home and contents insurance premiums. However the premiums of commercial property insurance have not increased to the same extent. This is partly because the commercial insurance markets are far more complex: there is a greater level of cross-subsidisation between different lines of cover, the level of competition also tends to be greater, and thus the influence of the insurance cycle is also greater. The international nature of elements of the commercial insurance market also makes the competitive dynamics different to the personal insurance market.

Nevertheless, the general trend towards more sophistication in pricing individual risks means that those that live or carry out business activities in high risk areas are more likely to face a greater insurance cost. Furthermore, for some insurers, the increased insurance losses in the high risk areas have led to a decision to exit certain areas or market segments where they believe the risks and costs are excessive. This can lead to issues of affordability and availability of insurance in the highest risk areas.

The recent weather-related perils insurance losses have resulted in increases in insurance costs for householders, more so for risks situated in the high risk regions. However, a range of other factors such as insurance and reinsurance cycles also play a part in the market. Whilst market forces have kept commercial property insurance prices in check for the time being, it is expected that there could be similar impacts in the future, particularly in light of the recent weather-related claims experience.

Appendix B covers in greater detail the factors influencing the pricing of insurance.

5.2 Reinsurers

Compared to primary insurers, reinsurers are disproportionately exposed to the large weather-related events owing to the structure of many reinsurance contracts. Accordingly, reinsurers employ experts in a number of disciplines such as engineering, meteorology, seismology, hydrology and actuarial sciences to construct and refine weather-related perils models covering markets across the globe.

In developing their technical premiums, reinsurers draw from both the past loss experience and sophisticated catastrophe modelling for a range of weather-related perils. When large weather events occur, modellers will use the data to revalidate and update their models.

Whilst primary insurers respond in general to local experience, reinsurance is a global market, such that the availability and price of reinsurance cover is subject to the impact global events have on the net assets and the capacity of reinsurers. Australia represents a small percentage of the total global reinsurance market. Consequently, although there is a correlation between the cost of weather events and reinsurance pricing, it is hard to ascertain any direct or automatic flow-through of claim costs to premiums. This is due to the methods which reinsurers use to estimate technical prices and the reinsurance pricing cycles arising from swings in worldwide reinsurance supply and demand.

Following the string of recent large losses, there are some indications that the global reinsurers may have upgraded the risk rating of the entire Australasia region, which may also increase the return on capital component in reinsurance pricing and result in an increase in both reinsurance and insurance premiums. This increase is potentially significant.

Appendix C covers in greater detail the factors influencing the pricing of reinsurance.

Part III Appendices

A Gaps in Insurance Coverage

Recent events have highlighted the problems faced by the community in the wake of weather-related events. Insurance plays a crucial role in shielding the community from the effects of such perils; however it is not able to be a comprehensive safeguard for all losses suffered, due to gaps in insurance coverage. Gaps arise from:

- Product gaps, including
 - Gaps in the range of insurance products available, or
 - Lack of availability of products to all potential customers
 - Lack of coverage within existing products
- Voluntary retention of risk through self-insurance, under insurance or non-insurance.

A.1 Product Gaps

Gaps in the range of insurance products

We observe that there are a number of risks faced by the community for which no insurance product is currently available. Of note is the value of coastal land, which can be a considerable portion of a homeowner's overall assets. Climate change could lead to a rise in sea levels, which will place more coastal land under threat of erosion and inundation. Potential solutions to this issue have been discussed (examples of these were included as part of IAG's submission to the previous Garnaut review). We are not aware of any significant progress in this area in the interim. Overseas' experience, particularly in Florida, indicates that some exposed areas may become uninsurable.

Climate change could create demand for new and expanded forms of insurance in Australia and elsewhere. In addition, activities undertaken to limit the effects of climate change could lead to a demand for new products.

Examples are:

- New products insuring mitigation activities:
 - Insurance for biosequestration (for example insuring the carbon stored within forests planted to offset carbon emissions).
 - Insurance for geosequestration. This could take two forms, both insurance of the operation itself, and insurance for liability to third parties from the activity.
 - Insurance for nuclear energy, if Australia decides to invest heavily in nuclear power generation to reduce carbon emissions.

- New insurance or financial products providing enhanced protection against operational disruption from weather events (i.e. supporting adaptation):
 - Protecting distribution / supply chains (e.g. for resources & agriculture)
 - Protecting against impacts of disruption in water supply
 - Protecting energy supply e.g. conditions being appropriate for renewable solar or wind power generation.

Barriers to creation of insurance products

Insurance can play a major role in assisting the community adapt to the consequences of climate change; however it will only be one element of any package of solutions.

The nature of most insurance products is that the underwriter sets the premium in advance of providing a defined cover. This funding mechanism is suitable when:

- The cover being provided can be clearly defined
- There is sufficient information on the risks so the technical price can be quantified with an acceptable level of certainty
- The price is affordable and there will be sufficient demand to make the product commercially viable
- The risks are not overly concentrated or correlated, or can be managed through reinsurance.
- The extent of risk is not determined by the behaviour of the policyholder (commonly referred to as moral hazard)

The nature of weather perils can challenge a number of these criteria. As such, the insurance industry may be unwilling to provide certain new forms of coverage that may be desired under a scenario of future climate change.

Even when the insurance industry is not well placed to underwrite the risks, it may be well placed to assist with some functions such as undertaking risk assessments, managing claims, assisting with customer communication and policy administration.

Lack of product availability to all potential customers

If climate change were to occur, many models suggest that this may increase the frequency and severity of certain environmental events. This may give rise to a situation where the premium required to cover the risk of an event occurring is prohibitively expensive, essentially making insurance unavailable. In practice many insurers address this situation by limiting some parts of the cover provided, allowing the insured to obtain cover for other perils that are part of the same product. However, this still leaves the insured with a lack of cover for the event in question.

The 2008 Garnaut report discussed at length the use of price as a decision driving tool in helping society to prepare for and to cope with the effects of

climate change. As an example of this, we may expect that a prohibitive cost of home insurance may cause individuals to move to a less risky area. The low replacement rate of housing stock makes this a challenging issue when considered at a whole of community level.

We consider that the insurance industry has a crucial role to play in creating risk-based price signals for certain activities, if this is viewed as desirable. However, we also note the potentially significant social costs of this sort of issue.

Lack of coverage within existing products

We note that in the current competitive marketplace, there are a variety of insurance products, often providing different coverage. Whilst it may be seen as desirable to offer a variety of products to suit the market's needs, this can also create issues of under insurance or non-insurance.

A.2 Voluntary Under Insurance and Non-Insurance

The detrimental effects to society of weather-related events are exacerbated by the issues of voluntary non-insurance and under insurance. We define this to be the situation where an appropriate product to offset the risk exists within the insurance marketplace, but is not purchased by the consumer (or has not been purchased to a sufficient degree to offset the full risk). This contrasts with a product gap, where the appropriate coverage is not available.

If climate change does occur and does lead to an increase in the frequency and severity of weather-related events, ensuring a high uptake of insurance will become even more socially desirable. As such, the issue of non-insurance and under insurance will become more prominent. Ultimately, a high uptake of insurance increases the resilience of the community to future events and serves to reduce the potential burden of the uninsured on the state.

We note the following potential issues relevant to this matter.

Insurance Taxation and Levies

There have been a number of papers written regarding this subject in recent years. Notable is 'The Non-Insured: Who, Why and Trends', published by the Insurance Council of Australia. Refer:

<http://www.insurancecouncil.com.au/Portals/24/Issues/The%20Non%20Insured%20-%20Report.pdf>

This paper makes the argument that significant taxes on insurance serve to increase the proportion of people who decide not to take out insurance. This effect can be seen to be particularly severe for those sections of the community with low disposable incomes, who are often the most exposed following a significant environmental event. We note that there have been developments in this area in recent months (for example the decision of the Victoria state government to accept in principle the recommendation of the Royal Bushfire Commission to abolish the fire services levy and replace it with a property based levy). However there are still areas where high levels of tax and levies on insurance exist. Removal or reform of these taxes and levies may serve to increase the uptake of insurance products within the community.

Affordability and consumer choice

Insurance is an unusual product in that consumers are essentially buying a promise, which only gets tested when a claim event occurs. Price and affordability plays a large role in determining the type and level of cover purchased by many insurance customers. This gives rise to a natural tension between the societal desire for a high take-up of insurance and ensuring a sufficiently high level of cover, since a higher level of cover will necessarily cost more. This issue is exacerbated by competitive forces in the market and by a lack of awareness of product differences amongst some customers.

One option for mitigating this is the compulsion of some level of cover. Whilst the desirability of this is a matter of opinion, this is already the case for some other products such as motor compulsory third party (CTP) and workers' compensation. However, we note that for these compulsory insurances, the policy coverage is for liability claims made by third parties against the policyholder. We consider that it is socially desirable to ensure that the victims of the actions of others have recourse to compensation, and thus there is a strong argument for compulsory coverage for CTP and workers' compensation (and, potentially, other forms of third party insurance). A similar argument for compulsory buildings insurance, for example, is less compelling, as buildings insurance covers the individual's own property, not the cost of compensating a third party for the actions of the insured. The effect of an insured event occurring to an individual who decided not to purchase buildings insurance is, therefore, limited to that individual (ignoring any assistance offered by the state).

Another potential option to reduce insurance gaps would be to standardise the minimum level of cover contained within a policy. However, this could be counterproductive, as insurers will only be willing to provide coverage if they can effectively set a price for the risk undertaken. This may lead to some insurers exiting certain markets altogether, rather than offering more limited cover that they are able to set a price for. Whilst this would ensure a minimum level of cover is present within the remaining policies on the market, this could lead to a reduction in competition. This could result in a rise in prices which may serve to increase the proportion of uninsured or underinsured individuals.

B Primary Insurers Pricing of Weather-Related Perils

We use the term primary insurers to refer to the organisations who underwrite insurance products offered to the end customers.

B.1 Pricing Approach

Overview

The practices used to set insurance premiums vary from insurer to insurer. Generally the larger insurers adopt a more sophisticated approach.

A key principle of the underwriting and pricing of insurance policies generally, and this also applies to the weather-related peril components of the coverage, is that the premium rates be risk-based, with cross subsidies restricted to homogeneous cohorts. Whilst insurance is largely based on pooling of risk, whereby individual claims costs are spread across a wider pool of policyholders, the community generally appears comfortable with the notion that higher risk policyholders should contribute more to the pool and vice versa.

Risk-based rating is important in order to produce fairness and equity among policyholders and to minimise anti-selection. However, it can lead to issues of affordability for those in the highest risk areas.

Costs built into Premiums

The premiums charged by insurers include components for:

- The expected average annual cost of the claims
- The insurers' expenses (e.g. commissions, claims management, overheads)
- Profit to cover the cost of capital
- The net cost of reinsurance, reflecting the difference between the premium paid by the insurer for reinsurance and the expected recoveries.
- Taxes and levies

The premiums charged for weather-related perils are also affected by these elements, being a part of the whole premium.

Prices charged by insurers do not always represent the technical premium (i.e. the theoretically correct premium). There are various reasons for this, with the influence of the competitive environment being the main one.

Rating Approach for Weather-related Perils

For property insurance, the weather-related perils premium for an individual property may be included by the insurer as a component of the overall premium, or it may be calculated as a separate premium that is added to premiums for other perils (theft, fire etc). Some insurers may utilise an overall

weather-related perils premium, whilst others may calculate separate premiums for each weather-related peril (e.g. storm, bushfire, cyclone etc).

The weather-related peril premiums for home insurance typically vary by the amount of cover being provided (most commonly measured using sum insured), type of construction (e.g. wood vs. brick) and by location of the property. Some insurers will vary their prices from house to house, whilst others will charge the same rate for all houses in suburb, a postcode or for a group of postcodes. The granularity and sophistication of this process varies by insurer, and may also vary within an insurer for each weather-related peril.

For other products, such as motor and commercial property insurance, similar types of information are considered. The specific factors vary from product to product and between insurers.

Insurers may also use excesses and policy sub-limits to manage their weather-related peril exposure. In some cases, insurers may decline to quote in high risk areas, or not offer coverage for certain perils.

Assessing the Cost of Weather-related Perils

Calculating of the average annual cost of each weather-related peril is a challenging exercise. For each region long time periods are required to assess the average cost across the full claims cycle. Potentially hundreds of years of data would be required if insurers were to set the price on the basis of the actual claims experience. Clearly this is not practical, and leads to the following approaches:

- For *storms*, which occur relatively frequently, insurers will tend to use actual claims experience over as long a period as possible. This may be supplemented by external data such as wind and rain data collected by the Bureau of Meteorology.
- The cost of *riverine flood* tends to be based on data from flood mapping, showing the estimated frequency and depth of floods for individual properties. The data, where available, can be used to estimate the average cost of damage that would result to a property from flooding. In the past insurers have been hampered by the shortage of available flood map data, although this position has been improving in recent years. Some insurers have historically provided flood cover on a community rated basis but the current trend is towards address based approaches, whereby the cost estimate can vary from house to house.
- *Bushfire* costs tend to be based on the actual cost of claims over as long a period as possible. Some insurers vary prices by individual address, based on factors such as the proximity to bushland and slope of the land.
- For *cyclone* claims, models have been developed by catastrophe modelling firms that can be used to simulate thousands of years of experience. These models are typically used by insurers to manage accumulation of risk – i.e. to ensure they have sufficient funds to cover, say, a worst in 250 year event. Some insurers also use these

simulation models to estimate the claims cost to build into premiums, and some insurers make use of in-house models.

For each of these perils, an insurer may make use of industry data (where available) as an additional source of information in order to assist in setting technical prices.

B.2 Response of insurers to recent catastrophes

The pricing approach followed by insurers continues to evolve, both in the nature of the analytics undertaken and the manner in which the price for an individual customer is calculated.

- Improvements are being made to how insurers estimate the average cost of claims, and this applies equally to weather-related peril claims as to other types of claims.
- Of particular note is that insurers have been investing more in recent years in their ability to price policies at the individual address level (rather than postcode). This trend may lead to large premium increases for some policyholders in the highest risk areas, although commercial considerations may serve to reduce this potential impact.

Insurers are also considering the impact of climate cycles, such as El Nino, on claims costs. These may be factored into analysis of past experience and the seasonal weather outlooks may also be considered.

Insurers are (almost) continually re-calibrating their cost models for weather-related claims as new experience emerges. Whilst the recent weather-related claims experience has been heavy, it is difficult to ascertain whether insurers have been explicitly increasing their estimate of the cost of weather-related perils, or have been merely updating and refining existing models assuming no long term change in underlying cost drivers.

Consideration may be given by insurers to the impacts of climate change on emerging costs, although we believe that the level of explicit allowance built in to prices so far is probably limited. To the extent that climate change has been a factor in the higher costs observed in recent years, this may implicitly be flowing through to higher estimates of future cost.

C Reinsurers Pricing of Weather-Related Perils

Reinsurers provide insurance products to primary insurers. These products transfer part of the overall risk and related claims costs from the primary insurer to the reinsurer.

C.1 Reinsurers' Pricing Approach

Technical Pricing

Technical reinsurance pricing is a function of risk premiums (i.e. the reinsurer's expected future claims costs), internal and external expenses and return on capital requirements. The reinsurer will also need to incorporate the cost and benefit of any retrocession coverage (i.e., reinsurance of reinsurance).

Reinsurers use two main approaches to technical pricing, often in combination: (1) experience rating, and (2) exposure rating. These are described in more detail below.

Exposure rated technical premiums are generally considered more credible and reliable than experience rated estimates. However, robust and detailed exposure rating models are largely only available for major perils such as tropical cyclone, earthquake and (increasingly) flood. Some reinsurers have also developed and are using exposure based models for bushfire and hail.

Other perils such as hail and storm are more widespread and variable in impact, but generally smaller in size. Detailed exposure based models are not widely available for these perils and reinsurers tend to rely more on experience rating and high level aggregate exposure models.

Experience rating may also be used as reasonableness check on the exposure based cost estimates, or blended with exposure based models.

Experience Rating

Experience rating focuses on historical reinsurance claims experience and uses this as the basis to estimate projected claims costs.

The experience rating approach is based on two steps: (1) collect weather event insured claims data and adjust for claims inflation, future additional claims reporting and changes in exposures, and (2) calculate the pro-forma reinsurance claims that would have been payable under the projected reinsurance structure.

- The key parameters are the number of years of claims history to use as the observation period and the factors used to project forward these historical claims. Since these factors are high level averages across an entire portfolio, the resulting estimates are always subject to high uncertainty. It is particularly difficult to judge if the claims observation period will be representative of the projection period. For example, there was low frequency of weather catastrophes in Australia from 1991 to 2005, but potentially higher than average frequency from 2006 to 2011.

- For some reinsureds, particularly smaller ones or new start-ups, historical claims data by weather event may not be available. Market/industry level information (such as that from Insurance Council of Australia) may be used and the reinsured's estimated market share by line of business/area/peril would be applied to reinsured's estimated proportionate share of industry claims cost for a very approximate estimate of pro-forma historical claims. Even for reinsureds with good historical claims data, adjustments for changes in exposure is quite difficult, since changes in underwriting policies or target markets (e.g., switching marketing focus from Victoria to Queensland) will not be reflected in simple exposure measures such as premium volumes.

Experience rating estimates are subject to high uncertainty, particularly for weather perils which occur infrequently such as tropical cyclones, since insurers can only draw inferences from weather-related claims which have occurred in the past.

The main shortcoming of experience rating methods is that, unless the historical experience includes weather events at the most extreme level possible, the experience rating estimate will fail to allow for the risk that these extreme events may occur in the future. Australia's experience in particular has not included any extremely large or "mega" events generating insured claims costs greater than \$10 billion, although such events are clearly possible.

Exposure Rating

Exposure rating combines the estimated exposure to loss (such as sums insured) with models of the weather peril to estimate claims costs by weather peril. Generally the weather peril models are probabilistic distributions, and the exposure rating exercise will provide reinsured claims cost estimates and the variability around these estimates.

Exposure rating approach is based on four steps: (1) build models of weather perils, estimate the key parameters and create a statistical distribution of weather events (for detailed models, this is a probabilistic weather perils event set of thousands of simulated possible cyclones or other perils), (2) construct a vulnerability model for the likely claims or damage ratio in relation to different constructions and exposures, (3) collect the reinsured's granular exposure data including geographic location and vulnerability rating, and (4) estimate original and reinsured claim costs by combining the distributions from the first three steps with the projected reinsurance structure.

Exposure rating approaches can require large amounts of information, and may rely on input from scientific experts such as meteorologists to build credible models of weather events such as tropical cyclones. A detailed claims cost model may use exposure data down to individual street address level and incorporate assumptions for land use, type of building construction, age of building and relevant building code, growth in insured values and the impact of demand surge (post event inflation in re-building costs).

Other Influences on Reinsurance Pricing

The above discussion relates to technical reinsurance pricing rather than the actual reinsurance premiums paid which are heavily influenced by market forces.

Reinsurance is a global market with global capacity, so is the availability and price of reinsurance cover are indirectly subject to the impact of major claims events worldwide and other financial impacts, because of the impact that such events have on the net assets of reinsurers and therefore the available supply of reinsurance protection. For example, after the terrorist attacks of September 11th, 2001, the capital and capacity of global reinsurers was greatly reduced and this resulted in higher reinsurance premiums across all lines of business.

Reinsurers' pricing is also a function of behaviour of other reinsurers in the market. Some reinsurers spend less time on technical pricing and will tend to accept pricing as offered (on the basis that it has been accepted by competitors who have undertaken technical pricing analysis).

As part of this global perspective, reinsurers write global books and as such reinsurance capacity is generally a global resource. Additionally, opportunistic capacity flows in and out of the market as perceived reinsurance returns increase relative to other investment opportunities in the capital markets.

C.2 Sensitivity of Reinsurance claims to weather events

The impact of weather-related claims on reinsurance claims costs with type of claim and type of reinsurance:

- Proportional reinsurance (i.e., the reinsurer and the reinsured have pre-agreed fixed proportions of claims and premiums) are more impacted by attritional weather activity, and often there will be a contractual limitation on the amount that reinsurers will have to pay per catastrophic weather event.
- Non-proportional reinsurance is divided into two types: per risk covers (i.e. the reinsurer covers the amount of large individual claims from both weather and non-weather sources above a deductible) and catastrophe excess of loss (the reinsurer covers the aggregate claims cost of the reinsured from each weather-related peril catastrophe event, subject to a deductible and limit).

The discussion below primarily focuses on catastrophe excess of loss reinsurance pricing, although much of the discussion is equally applicable to the catastrophic weather peril component of proportional and per risk reinsurance.

The impact of very large weather perils claims on both technical and market pricing is magnified for catastrophe excess of loss covers. This is because changes in the severity of weather events will affect excess of loss reinsurance more than would changes in frequency.

For example, in a specific scenario, the modelled claims cost estimate for tropical cyclone event may be \$12 million. If the insurer buys reinsurance coverage for claims greater than \$10 million, the expected reinsured claims cost for that scenario is \$2 million. However, if the severity of the insured loss increases by 10%, the insured's ground up claims cost increases from \$12 million to \$13.2 million, but the reinsured claims cost increases from \$2 million to \$3.2 million.

This leverage factor may be 150% or more, and means that reinsurers are extremely sensitive to factors which increase the size of insured claim costs, such as more severe or widespread perils, or inflation on building replacement costs.

Increased frequency in weather claims events and variability in claim severity may impact both the size expected claims and the uncertainty of the expected claim cost estimate. Because reinsurers must hold capital to protect their solvency against such uncertain events, the reinsurers' required capital levels may also increase, and this may increase the return on capital component of the technical reinsurance price.

C.3 Response of reinsurers to recent catastrophes

Impact on Technical Prices

Reinsurance pricing will tend to vary with high claims activity, particular large weather events, since reinsurers are disproportionately exposed to large catastrophe events due to the structure of many reinsurance contracts. As historical claims increase, technical claims cost estimates will change, although the extent of this will vary between experience rating and exposure rating approaches as discussed below.

- If reinsured weather-related claims are increasing, this will increase the estimated claims cost from an experience rating approach. Higher recent claims cost will essentially flow directly into the estimated technical premiums. This impact may be muted if a longer term historical measurement period is used to estimate the expected future recoveries (e.g., if the observation period is 20 years, the impact of one year of high claims experience will be much less than if the observation period is only the latest three years).
- The impact of claims events on exposure rating will tend to be more gradual and variable than experience rating.
 - Exposure rating is prospective in nature, and the perils distributions used by modellers will attempt to include a wide range of potential events. However, large weather events may be used to confirm if model assumptions are correct, or re-calibrate models if the reinsured claim costs are outside the range of potential outcomes. One recent example is the 2010 hailstorm in Perth – prior to this, most hail models did not include any allowance for hailstorms in Perth, so the event set for hail models were re-calibrated to include these scenarios.
 - When large weather claims occur, modellers will use the actual event data to "backcast" the model's result by

inputting the exact peril details, such as the tropical cyclone track, barometer pressure, wind speed, etc. and then using the vulnerability and exposure modules to generate anticipated reinsurance claim costs. By comparing this to actual emerging claim cost experience, the validity of the model assumptions is tested, and may be revised. Models are usually recalibrated after each event. Recent examples of this are recalibration of the vulnerability curves, for the demand surge impact from Tropical Cyclone Larry which was the first Queensland cyclone of significance since the 1970s, and recalibration of the coverage assumptions, for Hurricane Katrina and resulting claims from storm surge.

Some modellers update models annually and others more frequently. One particular impact of recent bushfire and flood claims has been the development and use of detailed exposure models for these perils by many large insurers and reinsurers. Exposure models were not in widespread use for these perils five years ago.

In addition to re-calibration of exposure models for past events, insurers and reinsurers will also aim to project observed trends in insured claims experience. This is difficult to do since it is almost impossible to separate the causes, which are a combination of (1) randomness (2) cycles, e.g., El Nino vs. La Nina (3) building development in high risk areas and (4) possibly climate change. Modellers may provide both long term and short term projections, based on long term average weather or immediate outlook for weather, e.g., if a very active tropical cyclone season is expected.

Impact on Premiums

Although there is a correlation between the cost of weather events and reinsurance pricing, there is no direct or automatic flow-through of claims costs to premiums due to the methods which reinsurers use to estimate technical prices (the theoretically correct price) and the reinsurance pricing cycles arising from swings in worldwide reinsurance supply and demand.

Reinsurers globally have relatively benign weather-related catastrophe claims in 2009, 2010 and the first two months of 2011. However, it is important to note that there has been very poor catastrophe claims experience in Australia and New Zealand. Given the reinsurance is a risk pooling mechanism at a global level, reinsurers may conclude that Australia and New Zealand represent a higher proportion of this overall risk, and may increase the risk rating and cost of capital requirements to continue to provide reinsurance. On the other hand, covering Australian and New Zealand risks has the benefit of providing geographic diversification to reinsurers.