Parametric risk pooling options for managing drought in the Australian wheat sector

Willis Towers Watson on behalf of the Queensland Farmers Federation with funding from the Future Drought Fund's Innovation Grant Program

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Glossary of Terms

Attachment – the value on an index at which a policy begins to pay

Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) – federal research arm for the Agricultural department.

Basis risk – the difference between the loss incurred and the claim payout received

Bureau of Meteorology (BOM) – Government agency providing weather services to Australia

Coinsurance - splitting or spreading of risk among multiple parties

ECMWF Reanalysis v5 (ERA5) – a dataset which provides hourly estimates of atmospheric, land and other climate variables

Exit – the value on an index at which a policy has reached its maximum payout

Index – measurements of a parameter with values that change over time

Moderate Resolution Imaging Spectroradiometer (MODIS) – satellite sensor used for earth and climate measurements

Normalized Difference Vegetation Index (NDVI) – an Index that quantifies the health of vegetation on the ground using satellite imagery

Parametric solution – an alternative to traditional insurance whereby losses are calculated based on the occurrence of objectively defined events

Risk pooling – aggregating individual risks into a pool, allowing the losses of a few to be funded by the premiums of the many.

Risk layering – combining various tools such as risk transfer via (re)insurance, retention, and financing.

Tick value – the pay-out value associated with each movement (the 'tick') on the Index

Trigger – a pre-determined benchmark on the Index at which the policy starts paying.

Executive Summary

This report outlines the development of parametric solutions to de-risk wheat production in Australia and suggests how such solutions could be implemented to support the agricultural industry in managing its exposure to drought risk. Efficient distribution, risk pooling and risk layering approaches are also explored.

Parametric solutions pay out a pre-agreed sum once an objectively defined event has occurred. Claims are calculated based upon independent data and are paid quickly after the verification of the event without the need for on-site loss adjustment. Parametric solutions typically focus on a single peril, in this case drought. This focus allows more affordable solutions to be developed compared with Multi-Peril Crop Insurance (MPCI), which due to its broad form cover, tends to be more expensive per hectare than a properly structured parametric solution.

Wheat as a commodity was chosen because it is the largest crop grown in Australia by area planted and by tonnage and is grown in all states of Australia[1]. Adverse weather conditions such as drought have profound impacts on wheat yield.

In the development of parametric insurance solutions our research considered four different indices that respond to drought:

- state yield,
- NDVI as a yield proxy,
- rainfall, and
- soil moisture

We examined both single trigger and dual trigger parametric insurance solutions based on these four different indices.

The most promising approach was the single trigger parametric insurance solution based on state yield, so we then analysed the impact on premiums of two structuring techniques:

- geographic diversification and
- risk layering

Our analysis concluded that the risk profile of drought impacts on Australia's wheat sector is lowest when combining geographic diversification and risk layering and that by implementing both of these approaches there is the potential to achieve substantial premium savings.

[1] https://www.britannica.com/place/Australia/Agriculture

The key findings discussed in this report include the following:

There is good correlation between wheat yield and rainfall at state level in Australia.

- Wheat yield data from Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) showed low yields in known drought years, as reported by the Bureau of Meteorology (BOM), notably 2002–2003 and 2017–2019.
- This relationship is true in all states, although the correlation is weaker in Queensland.
- Correlations also exist between wheat yield and vegetation health Normalized Difference Vegetation Index (NDVI) and soil moisture levels.

Historic wheat yield data is only available at state level.

- There are opportunities to improve the richness of the data available. A higher granularity of data would allow more tailored insurance solutions to be developed. Such data would also improve planning, management, and decision making for the agricultural sector.
- This report concludes that there is a role for government to consider supporting the improvement of yield data reporting for use by the insurance industry for development of parametric products.
- Australian Bureau of Statistics (ABS) are investigating new data sources that will improve regional level crop data on an annual basis.

Rainfall, NDVI and soil moisture data are available at regional level.

- The existence of datasets is crucial for the development of parametric solutions because they rely on objective data to define the characteristics of an event that triggers a claim. These solutions require significant modelling and structuring, which is underpinned by robust, independent datasets.
- Rainfall data is available from BOM observation stations located throughout the research area.
- Normalized Difference Vegetation Index (NDVI) data is available from the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite. NDVI quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs).
- Soil moisture data is available from the ERA5 data set provided by the European Centre for Mid-Range Weather Forecasting (ECMWF).

Parametric drought solutions can be developed that would protect wheat farmers in the event of significant droughts that impact yields.

- There are several indices that could be used as the parameter for a parametric solution.
- The optimum index for the farmer is the one which provides the best proxy for crop yields.

- There is a trade-off between spatial accuracy (if state yield is used) and the imperfect correlation between wheat yield and the proxy index if either rainfall, NDVI, or soil moisture are used.

A prototype structure has been developed based on assumptions on farmer up-take level and planted wheat area.

- This prototype uses state yield as the parametric index.
- It assumes that drought is a wide scale phenomenon which impacts wide areas concurrently and that state yield (t/ha) will provide a good proxy for the yield of the individual farmer.
- The model concludes that developing a portfolio solution which includes all states and utilising reinsurance (risk layering) results in a lower insurance cost to the individual farm business (see Figure A and Table A). Figure A illustrates the role of reinsurance in reducing the overall cost. Reinsurance provides protection to the insurer in years of extremely high losses (catastrophic scenarios), which allows them to reduce the premium that they would otherwise need to charge for such risks. International reinsurers are more able to absorb such catastrophic scenarios as their book is diversified across multiple regions rather than being concentrated in Australia.
- By adopting both of these approaches, it is estimated that the cost will reduce by around 15% compared to using a state-by-state approach without reinsurance.

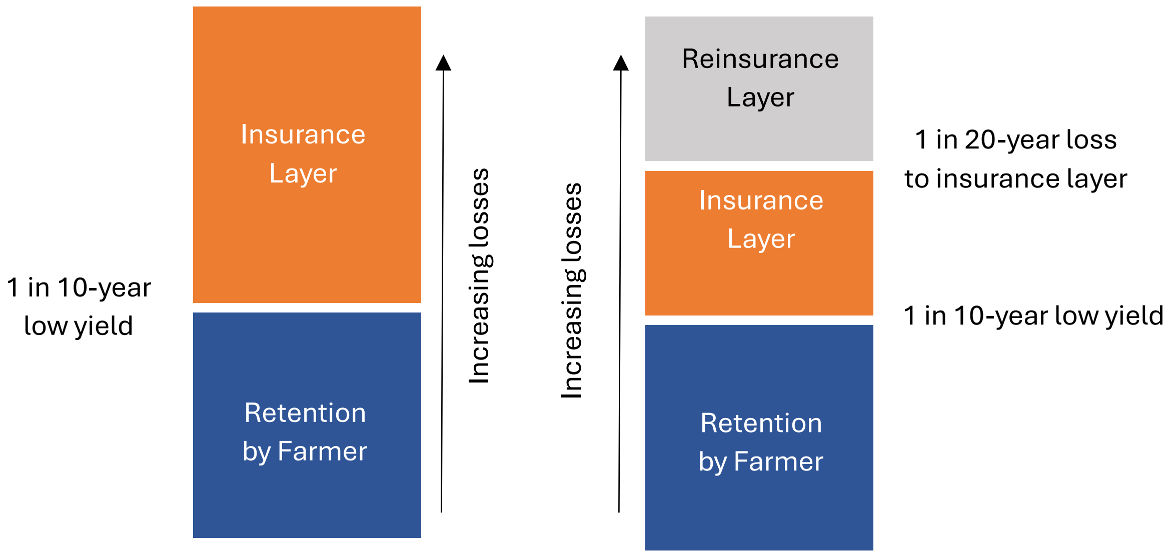

Figure A "Insurance towers" for farmers used to understand the overall insurance framework.

The insurance structures that we discuss can be understood by relating losses to "insurance towers" (Figure A). The losses sustained by farmers increases with distance up the tower. The blue boxes show farmer retention, which are losses at levels that the farmer does not receive any pay-out from insurance. The orange boxes above the blue boxes indicate that an "insurance" layer, at which an insurance company pays a farmer, is reached at losses above a certain level at which farmers retain their losses. In our modelling, farmers retain losses relating up to the 1-in-10-year low yield i.e. only in the worst 10% of years should a farmer receive a pay-out from the insurer. The grey box above the insurance layer shows a reinsurance layer, relating to the level of losses at which the insurance company itself buys insurance (so-called "reinsurance"). When the losses reach the reinsurance layer, the insurance company receives a pay-out from a reinsurer. This reinsurance layer attaches at losses for the insurance layer that occur once every 20 years, meaning that the reinsurance company is making a payout, on average, only once every 20 years.

There are premium savings via a national insurance program, rather than each state purchasing insurance individually.

- This has been modelled using "technical" premium that would need to be charged for the portfolio.
- Actual premiums may be different, particularly if the take up across each state varies or if the cost or attachment point of the reinsurance changes. Any changes to taxes will also impact the results.

State	Scenario 2 Each state individually purchases insurance and reinsurance (AUD)	Scenario 4 All states together purchase insurance and reinsurance (AUD)	Saving (AUD)
WA	$4.87m	$4.38m	$490,000
NSW	$4.62m	$4.16m	$460,000
SA	$4.09m	$3.68m	$410,000
VIC	$1.65m	$1.49m	$160,000
QLD	$1.30m	$1.17m	$130,000
Total	$16.5m	$14.9m	$1.6m

Table A The cost of each state individually purchasing insurance and reinsurance, the cost of each state purchasing insurance and reinsurance together, and the savings that might be achievable for each state if insurance and reinsurance were to be purchased together.

The higher the take up of insurance, the lower the average cost per farm business.

- Pooling risk is the most efficient mechanism for reducing cost.
- The greater the diversification of the pool the lower the average cost per participant, so encouraging take-up is of benefit to all.
- Drought risk in Australia is systemic, so utilising international reinsurance allows this risk to be commingled with risks outside of Australia.

Government support can play an important role in the development of a sustainable, successful insurance program.

- The uptake of insurance by farmers in Australia is very low contributed by adverse selection, poor results and increasing premium costs[2].
- To build a successful programme, up-take needs to be encouraged.
- In economies with successful agricultural insurance schemes government support to foster market confidence is an essential element.
- Support can take many forms from offsetting of premium costs to the removal of associated frictional costs such as Goods and Service Tax (GST) and Stamp Duty or through facilitating the establishment and financial efficiency of mutualisation mechanisms.
- The cost of such interventions will be significantly lower than government support provided in many other countries with equivalent agricultural sectors and could be viewed as an efficient mechanism for supporting farming businesses to recover post disaster.

[2] https://www.qff.org.au/projects/insurance/#:~:text=While%20farmers%20are%20generally%20aware,results%20and%20increasing%20premium%20costs.

Summary of Analysis

WTW conducted an analysis across the main wheat growing regions in Australia to investigate the impacts of drought on wheat crop yields. The crop growing regions of five states were taken into consideration for the analysis: Western Australia (WA), New South Wales (NSW), Queensland (QLD), Victoria (VIC) and South Australia (SA) (see Figure 1a). Aggregated wheat yield data from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) was used to calculate average wheat yields across the five states. This high-level analysis showed low yields collectively across all states in known drought years according to the Bureau of Meteorology[3] (e.g. 2002–2003, 2017–2019) (Figure 2).

There are often three classifications defined with “drought”. Firstly, meteorological drought occurs when there is a prolonged period of low precipitation (i.e. low rainfall). These meteorological droughts often lead to hydrological drought, defined as when the water supply is adversely affected (i.e. low soil moisture). After a prolonged period of meteorological and hydrological drought, an agricultural drought may then occur (i.e. low crop yields). Evidently, we are interested in agricultural droughts, but we can and do use proxies for meteorological droughts (low rainfall) and hydrological droughts (low soil moisture) to estimate the occurrence and severity of agricultural droughts (low crop yield).

Helpfully, the Bureau of Meteorology defines rainfall deficiencies that lead to drought as “serious”, “severe” or “lowest on record”. “Serious deficiency” occurs when the rainfall is between a 1 in 10-year and 1 in 20-year low. “Severe deficiency” occurs when the rainfall is lower than the 1 in 20-year low. “Lowest on record” refers to the lowest value since at least 1900, when measurements began, meaning approximately a 1 in 100-year low rainfall. The parametric solutions proposed here are designed to start paying at the 1 in 10-year low (of rainfall, soil moisture or crop yield) and reach maximum pay-outs at the 1 in 100-year low (of rainfall, soil moisture or crop yield). In effect, the insurance would cover the droughts that are due to “serious deficiency”, “severe deficiency” and “lowest on record” rainfalls.

For further granularity, WTW investigated which regions specifically suffered from low yields during drought years (Figure 1b).

However, at the time of writing the report, ABARES historical yield data was incomplete at higher granularity than the state level meaning that regional level analysis needed to be undertaken using a different dataset.

The project team note that the Australian Bureau of Statistics (ABS) in collaboration with ABARES are investigating new data sources that will improve regional level crop yield data on an annual basis. However, the first release of this data came late in the development of this report and therefore has not been used for the scenario analysis. The use of this data has been discussed further later in the report.

[3] http://www.bom.gov.au/climate/drought/knowledge-centre/previous-droughts.shtml

As such, the Normalized Difference Vegetation Index (NDVI), an index relating to vegetation health, from the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite was used as a proxy for yield at higher granularities (Figure 1a). The validation analysis showed that wheat yield is closely correlated to annual average NDVI for four of the five states (WA, NSW, VIC, SA). Through this connection between NDVI and wheat yield, it was inferred that low wheat yields could also be captured at a regional level through annual average NDVI for WA, NSW, VIC, and SA. The definition of the regions we chose to use for our analysis was from the Australian broadacre zones, which divide states into pastoral zones, wheat-sheep zones, and high rainfall zones (Figure 1b). We used the wheat-sheep zones in our regional analysis. Typically, there are 2–3 wheat-sheep zones in each state.

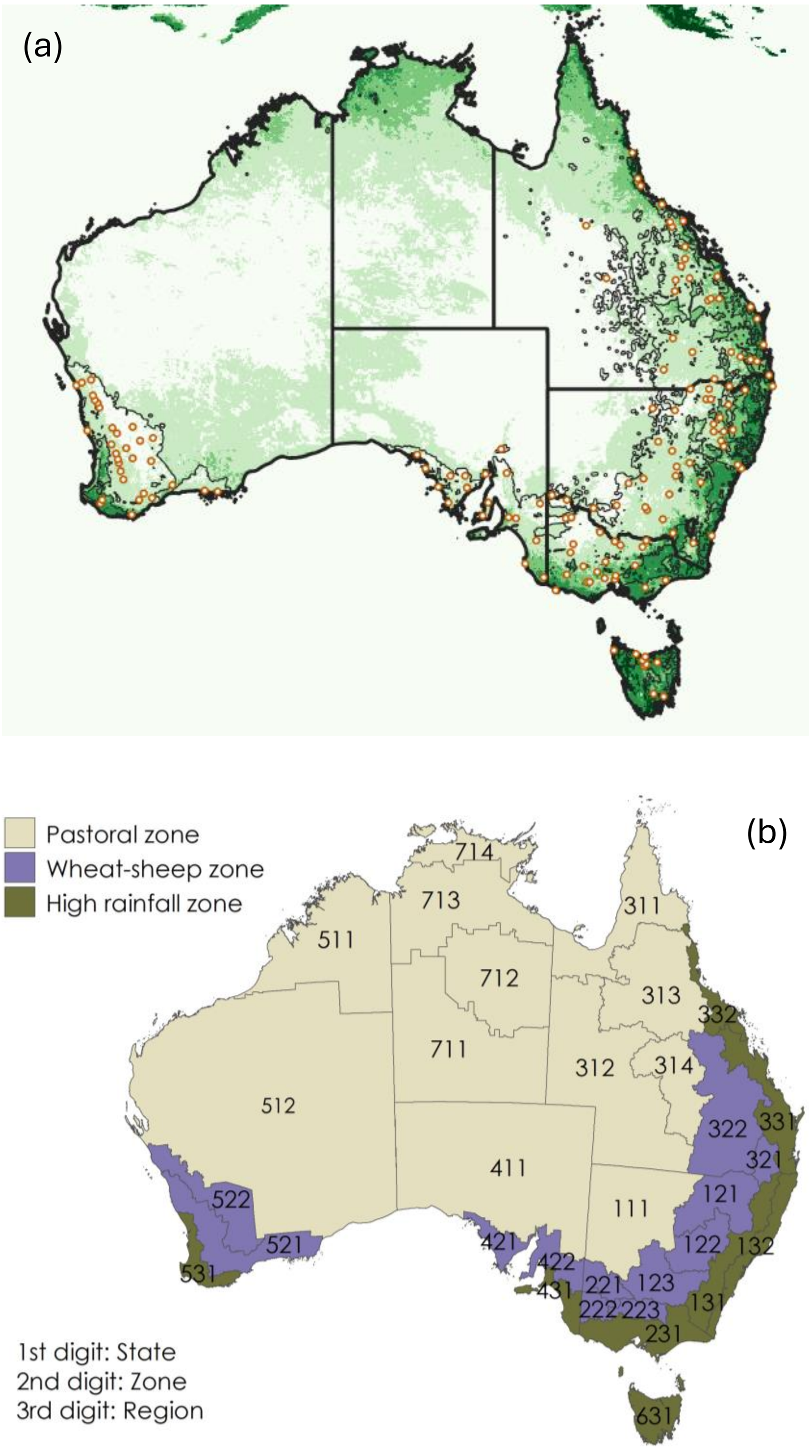

Figure 1 (a) Top, a map of Australia indicating the division by state (thick black lines), and crop growing regions (thin black lines). Weather stations used for rainfall are shown as orange dots with white centres. The NDVI for December 2018 is shown in shades of green. (b) Bottom, the regions used for analysis. The wheat-sheep zones that are used for WTW's regional analysis are shown in purple. These zones are commonly used in agricultural studies across Australia. Although Tasmania is shown on these maps, we do not include it in our analysis.

To produce indices that capture drought, and which would be acceptable as a reference index for parametric solutions, we used two datasets, rainfall and soil moisture. As such, WTW created the first index using measured rainfall from ground observational weather stations as reported by the Bureau of Meteorology (BOM) (see locations in Figure 1a). Specifically, the index was average rainfall between April to October to align with wheat growing seasons. WTW also created a second index using gridded soil moisture from a dataset called "ERA5" from the European Centre for Mid-Range Weather Forecasting (ECMWF). Specifically, this index was the geographic average soil moisture across each region between April and October. Analysis of these indices showed that for the locations we considered[4], gridded soil moisture is a better indicator of poor yields than measured rainfall. We also conclude that low soil moisture at the regional level is well correlated to low NDVI (and, as such, yield) in four of the five states (WA, NSW, VIC, SA).

Therefore, we would suggest that soil moisture from ERA5 is likely a reasonable indicator of drought across most of Australia, that is well correlated to low yields at the state and regional level and can be used for parametric solutions.

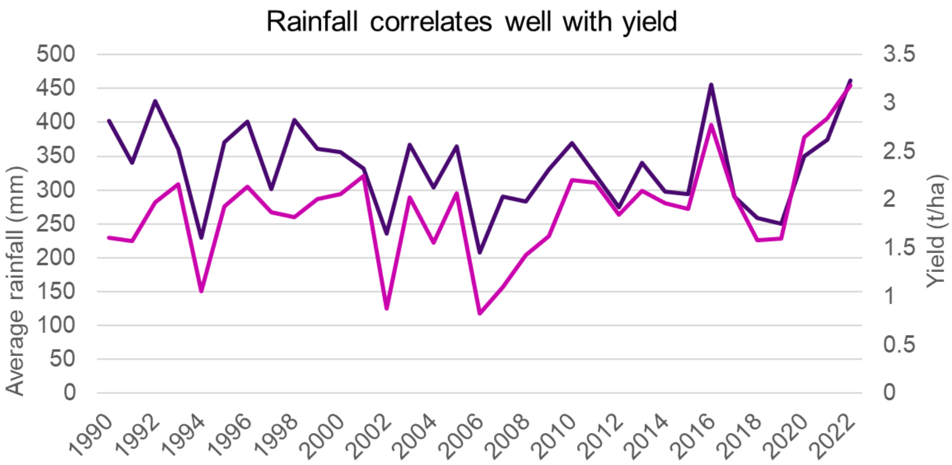

Figure 2 – Rainfall in April to October inclusive (purple, from the Bureau of Meteorology) and annual average wheat yield from each state (pink, from ABARES) across Australia showing high correlation.

We also investigated the strength of correlation of drought between different regions. A high correlation would indicate that two regions suffer from drought in the same years, and as such could be considered together in a potential parametric solution. Using aggregated data over larger areas would simplify the development of parametric solutions. For example, if farmers purchase parametric drought insurance developed for an entire state, then it could be technically and administratively simpler than a parametric solution that is tailored for their specific farm. There may, however, be basis risk implications of this approach as discussed below.

[4] The analysis included broadacre regions as defined by ABARES

Through analysis of NDVI, rainfall and soil moisture, we found that regions tended to be highly geographically correlated to one another, e.g. when one region had low yield, other regions that were close by would also suffer from low yields.

This result is consistent with the fact that droughts are geographically widespread and relatively homogenous.

This suggests that a state level parametric solution could provide valuable protection against low yields for wheat farmers in Australia, albeit that using an aggregated state level index will increase basis risk for farmers. For example, using the state level index, there is a possibility that the policy does not trigger because the state has not suffered a sufficiently widescale drought, but the individual farmer has suffered a drought in their specific region of the state.

However, WTW's analysis suggests that the basis risk from aggregation is relatively small (e.g. soil moisture is 94% correlated between regions in SA), and the potential benefits from simplification may outweigh the increase in basis risk for the policy. Using state level data will also likely reduce the cost of the policies which will increase the uptake.

It is also the case that wheat yield data (which provides actual yield data rather than an index which is used as a proxy for yield) has until recently only been collected at the state level, so a parametric solution based on yield can only be developed at state level due to the lack of publicly available historical data. Given the data limitations for yield at a state level outlined above, we have also explored structures that use a proxy for yield such as NDVI and rainfall at a regional level in an effort to present all the viable structures that may present solutions as risk transfer options for drought.

Proposed structures for a Parametric Drought Solution

With soil moisture and NDVI confirmed as good proxies for drought and low yield, and the relatively homogenous nature of risk, WTW propose the following potential structures for a drought parametric solution for the Australian wheat industry. To roll out such solutions to farmers at a larger scale, this would have to be embedded into insurance models, discussed under section: "Distribution, pooling, and insurance mechanisms".

1) Single Trigger – Parametric Index only

a) Pay-out: Based on severity of drought as determined by gridded soil moisture (ERA5) at national, state, or regional level.

b) Pay-out: Based on severity of drought as determined by rainfall measurements (BOM) at national, state, or regional level.

2) Single Trigger – Yield Index only

Pay-out: Based on severity of yield losses as determined by yield data (ABARES) at national or state level. If regional level yield data were available, this structure could be offered at regional level which would reduce basis risk for the farmer.

3) Single Trigger – Yield-Proxy Index only

Pay-out: Based on severity of proxy yield losses as determined by NDVI data (MODIS) at national, state, or regional level.

Figure 3 – Potential parametric solution indices with a single trigger.

For the above solutions, if the index (i.e. soil moisture, rainfall, yield, or NDVI) is below a pre-defined low threshold, then this triggers a pay-out to farmers that have purchased the cover. Typically, for insurance purposes, this threshold should be sufficiently low such that premiums are affordable but also the threshold should be high enough such that the coverage provides real value to the insured. As such, parametric insurance solutions aim to attach between the 1-in-5 year to the 1-in-20 year low, meaning that the insurance pays out in 5-20% years. This methodology should work well for WA, SA, NSW, and VIC (QLD is discussed below). The payout amount is tailored to reflect the expense that farm businesses wish to cover, which will be aligned to the likely impact of the drought on production, revenue, profits, or additional expenditure.

Farmers should be able to tailor pay-outs to their expected cost for a loss in yield. For example, in parametric insurance you can assign an incremental value (a "tick value") for pay-out (here: "$/t"), an area insured (here: "ha"), and then the pay-out will be calculated on yield (here: "t/ha"). Differences in incremental values can be assigned by different farmers. For example, because of differences in expectations of crop value, or differences in farmer expenses, Farmer A may assign a value of $300/t, but Farmer B may assign a value of $350/t. The differences in these assigned tick values will be ultimately reflected in the premium that the farmer pays, with Farmer A paying less for insurance than Farmer B, with all else held equal.

Although there is flexibility within a parametric insurance programme, restrictions may be imposed on various aspects of the cover to maintain affordability for the insurer, for example:

- how much value a farmer can assign to their crop (e.g. no more than $400/t).

- how much area in any given state is insured to ensure sufficient diversification (e.g. no more than 20% of the total crop area in any given state).
- a minimum reduction in yield that will correspond to insurance payouts (e.g. at least 1 in 10-year low yield as determined at the outset of the analysis).
- a maximum payout amount for any individual farmer on a policy (a cap on the overall maximum pay-out, calculated through a combination of value, area insured, and yield reductions).

Further Analysis for a Parametric solution in Queensland

The analysis outlined consistently showed a weaker relationship between yield and proxy data sets in QLD compared to other states. For example, whilst the overall vegetation health (NDVI) in QLD is highly correlated with soil moisture, the wheat yield is not as well correlated with rainfall, soil moisture, or NDVI.

Nevertheless, simply excluding QLD from the parametric solution is not desired or feasible. A simple solution to include QLD could be to use ABARES wheat yield data aggregated at the state level. The benefit of this solution is that it ensures that the parametric solution uses the same data for QLD as the other states. Maintaining consistency and adopting the same approach across all the states helps increase the transparency of the solution to farmers.

The drawback to this would be that farmers will only receive a pre-defined amount based on a basic pay-out function depending on their state i.e., one farmer may have suffered a loss but because the overall state yield was above a pre-defined limit, no pay-out is made to the farmer. This concept of pay-outs not matching the level of loss experienced is known as basis risk; this is prevalent in most insurance policies, not just parametric programmes. Basis risk also exists in more traditional insurance policies through deductibles, exclusions and errors in loss adjustment processes. Therefore, if farmers require pay-outs tailored to their loss experience, then more geographically specific granular data is needed which is currently missing from ABARES but may become available in light of changes to the way the data is collected. More research would be required to investigate the validity of this data for insurance purposes.

Another alternative solution to include QLD is a dual trigger parametric solution.

This would be in the form of a policy that combines an index trigger with a secondary pay-out function based on either reported state yields, reported farmer yields, or a yield proxy such as NDVI. Parametric solutions with this underlying structure have been executed and managed by WTW for over a decade for a large farmers' mutual in the UK. This policy has a primary temperature trigger, which if met activates the policy. Payments are then calculated based on individual farmers' reported yield relative to a pre-agreed value. A similar structure can be applied using the below parameters shown in Figure 4.

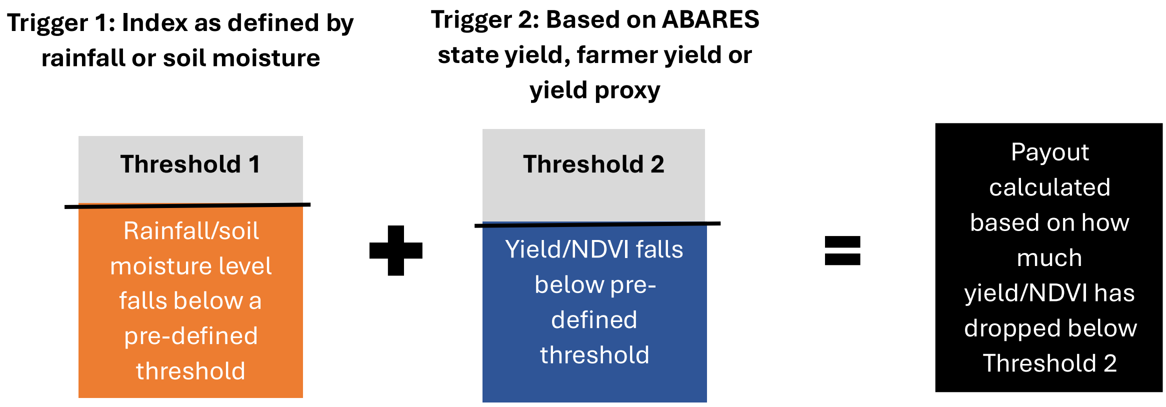

Figure 4 – Pay-out structure for a dual trigger parametric insurance solution.

Dual Trigger – Drought Index as a Trigger + Pay-out based on yield or yield-proxy

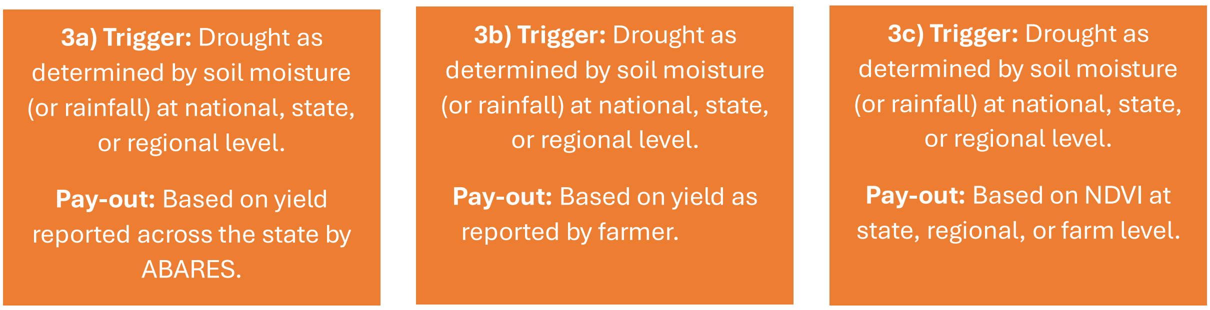

Figure 5 – Potential parametric solution indices with a dual trigger.

Of these structures, option 3a is likely the most achievable. The required data is available for all five states, so a consistent approach could be implemented. The policy would be activated based on an agreed measure of drought at the national, state, or regional level (to be further investigated). Pay-outs would then be calculated based on state level yield relative to a pre-agreed threshold. Option 3b is not yet readily available since this requires farm-level yield reporting, and Option 3c would only work for four out of five states due to the low correlation for QLD.

Support initiatives for a successful risk pooling approach

This section discusses how government can support the accessibility of insurance to farmers. The following points are discussed:

- Improved yield data collection
- Premium support
- Removal of stamp duty and GST
- Education on risk management

Improved Data Collection

Government can encourage more granular wheat yield data collection. As previously discussed, ABARES yield data is available at state level but not at regional level. Due to the lack of regional yield data, the analysis that WTW has conducted has used NDVI as a proxy for regional yield. Whilst we can show that wheat yield and NDVI are well correlated at the state level, we have had to assume that these correlations broadly hold true at the regional level, affecting the robustness of our analysis and the conclusions that can be drawn about the efficacy of a parametric drought solution. In particular, the analysis of the effect of drought on wheat yield in QLD has suffered because it is difficult to find a robust correlation between wheat yield and NDVI in QLD. To develop a more robust index that works at farm level, accurate, reliable, and consistent data reporting at the regional level is needed. This would allow for increased granularity when developing parametric solutions, meaning that basis risk for farmers would be reduced. There is a role for government to support the efficient distribution of insurance to farmers for example, through a platform where farmers enrol onto the programme and record yield data.

The Australian Bureau of Statistics (ABS) recently issued a paper on new data sources that will improve regional level crop data on an annual basis[5]. ABS have published 2023-year regional data via their Data Portal; this data includes levied production (tonnes), crop area (hectares), local value of levied crop (AUD) and number of levy payers. Investment into these new data sources is good news for the insurance industry and particularly for developing Parametric Solutions.

The regional statistics are produced using a combination of Levy Payer Register data, satellite derived crop mapping and industry harvest information. The Levy Payer Register data contains details of the quantity of crop sold/used in commercial production, the local value of crop and business address information for all relevant producers[6]. The regions are defined according to Australian Statistical Geography Standard, Statistical Area Level 2[7] which is much more granular than the Broadacre zones used in our analysis. There is potential to use this data to help structure a regional programme, but this would require more years of reporting (beyond 2023) and confidence that this data will be reported consistently and accurately.

Nevertheless, consistent reporting of regional level data will have benefits beyond insurance solutions. A more robust and granular dataset on farmers' yields will allow more detailed analyses, allowing for better planning, management, and decision making for the agricultural sector.

Premium Support

Globally, governments support the sustainability and growth of accessible parametric insurance products for agriculture through premium cost offsets and regulation to make crop insurance

[5] https://www.abs.gov.au/statistics/industry/agriculture/australian-agriculture-broadacre-crops/2022-23#data-downloads

[6] https://www.abs.gov.au/methodologies/australian-agriculture-broadacre-crops-methodology/2022-23

[7] https://portal.ga.gov.au/metadata/statistical-boundaries-australian-bureau-of-statistics-abs/australian-statistical-geography-standard-asgs-2021/statistical-area-level-2-sa2-2021-generalised-abs/80ac3bb2-6df3-42d0-86b7-1a443c664559

more attractive. According to ABARES, farmers in Australia are the least financially assisted in the world[8] which may go some way to explaining the low take-up of insurance by the Australian agriculture sector.

ABARES states that "Where direct farm support is provided, it is concentrated on risk management tools to help manage Australia's uniquely variable climate. These tools include Farm Management Deposits and income tax smoothing"[8]. This supports the argument put forward in this report that direct farm support mechanisms such as premium cost offsets are consistent with current support initiatives. And could go a long way in incentivising the uptake of crop insurance as a risk management tool.

In order for a pooled parametric mechanism that supports preparedness to be successful in Australia, government may wish to consider a co-funding arrangement that encourages uptake of the policy in the early years. Increasing the accessibility of insurance for farmers will serve as a protection for vulnerable farmers who may be disproportionately impacted by agricultural risks.

In most commercial insurance programmes, approximately 50% of the premium goes towards covering the risk (i.e. pay-outs from the policy) and 50% accounts for fixed costs for the (re)insurer, margin for the (re)insurer, fronting fees, brokerage, and tax. This commercial model means that when comparing premiums to payouts, insurance can seem expensive to the buyer.

Introducing a 50% funding on agricultural insurance premiums, at least in the first few years of piloting a programme, will change the perception of "value for money" and encourage farmers to buy this valuable protection.

Removal of Frictional Costs

Government could also consider the removal frictional costs such as stamp duty and GST from insurance premiums which currently adds ~20% to the premium cost for farmers in QLD, WA and SA and 10% for farmers in NSW and VIC. These frictional costs further increase the cost to farmers and act as a disincentive to insurance purchasing. Given the different frictional costs that currently apply across the states, any national insurance programme would need to have frictional costs applied consistently to ensure equity between the states.

Education on Risk Management and Insurance

Another way to encourage insurance take-up is through education. Education on drought risk, the impact of climate change and the insurance and risk management options available can empower farmers to foster a proactive approach towards utilising insurance as part of their overall approach to managing risk and cultivating sound farming practices. As such, encouraging education should be undertaken in partnership with direct government support through funding or regulation.

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[8] https://www.agriculture.gov.au/abares/research-topics/trade/analysis-of-government-support-agricultural-producers

Support through Reinsurance

Government could participate by providing reinsurance which attaches at the expected level of claims. It is assumed that the cost of this intervention is provided for free by the Government. This means that the cost to the farmer would be in line with the claim payouts. Government would, in effect, be picking up the non-loss costs including distribution, taxes and the costs of volatility. In catastrophic drought years this cost would be substantial as claims would significantly outweigh premiums; in non-drought years it would be much less. This type of government intervention is already apparent in Australia through the Australian Reinsurance Pool Corporation[9] which provides reinsurance cover for losses such as terrorism, cyclone and flood damage.

Modelling the impact of government support for the insurance sector

The uptake of insurance of any form by farmers in Australia is very low. Affordability issues are typically cited as the key driver of this. Farmers don't perceive there to be value in insurance, which may reflect their willingness to accept risk, their resilience to losses, or a perception that premiums are too high compared with the claims paid.

Internationally many governments choose to support insurances that de-risks the agriculture sector. Support can take many forms including:

- Premium support
- Removal of frictional costs such as taxes
- Provision of reinsurance or capital support for the insurance vehicle

We have modelled three scenarios that the Australian Government could consider and have shown the impact on the premium cost to the farmer.

- A premium funding of 50%.
- Removing GST and stamp duty (note that stamp duty is already 0% for crop and livestock in NSW and VIC).
- Government providing reinsurance which attaches at the expected level of claims. It is assumed that the cost of this intervention is provided for free by the Government. This means that the cost to the farmer would be in line with the claim payouts. Government would, in effect, be picking up the non-loss costs including distribution, taxes and the costs of volatility. In catastrophic drought years this cost would be substantial as claims would significantly outweigh premiums; in non-drought years it would be much less.

Table 1 Results of government funding on gross premium payable by farmers.

[9] https://arpc.gov.au/about/

Policy	Total gross premium (AUD)	Total gross premium for farmers (AUD)	Total Government funding (AUD)	Funding percentage
No policy	$14.9m	$14.9m	$0.0m	0%
Cover 50% of gross premium	$14.9m	$7.45m	$7.45m	50%
Remove GST and Stamp Duty	$14.9m	$12.3m	$2.6m	17%
Reinsurance for all non-loss costs	$14.9m	$8.2m	$6.7m	45%

Although these interventions come at financial cost to government, it is worth noting that, as a percentage of the premium all are lower than the funding provided to other equivalent economies and with agricultural sectors such as the US government provided to the Federal Crop Insurance Program (being 63%). It is also the case that many farmers receive post event payouts, so Government is already providing financial support to the agriculture sector – but post-loss rather than pre-loss.

Non-insurance Solutions

Non-insurance solutions (i.e. risk reduction through management) should always be considered in conjunction with insurance solutions (i.e. risk transfer). From a financial perspective, it is usually a more cost efficient to reduce risk before transferring any remaining risk to the insurance market or other risk takers.

For example, as part of a risk management strategy, continued government support of research and development specifically the development of drought resistance crop strains is essential.

The severity and frequency of droughts are also increasing due to climate change. Climate change is linked to the emission of greenhouse gases from fossil fuel consumption. As such, any reduction in fossil fuel consumption will mitigate the severity and frequency of future crop losses due to droughts. Australia's commitment to reducing greenhouse gas emissions by 43% below 2005 levels by 2030 and achieving net zero emissions by 2050 will be acting to reduce potential crop losses due to drought.

Distribution, Pooling, and Insurance Mechanisms

For any risk transfer solution, there needs to be an efficient distribution mechanism through which the product is sold to the farmer. There also needs to be an effective methodology for pooling and diversifying risks. We show two approaches that may work for farmers in Australia.

Mutual Model

In the Mutual model, farmers individually purchase an insurance policy from a drought insurance mutual. Mutualisation allows farmers to benefit from lower overall premiums that insurance companies may otherwise charge. Benefits such as profit sharing or premium deferrals are possible in a mutual arrangement.

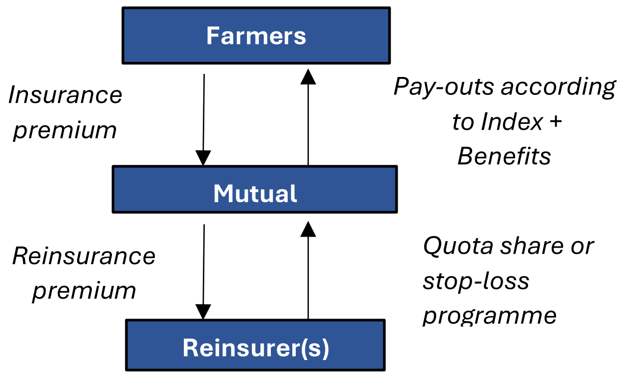

Figure 6 – Mutual model for farmers purchasing insurance.

With any insurance model, insurance premiums are viewed as an extra cost and farmers will decide whether to buy cover based on their view of the value for money of the premium compared with the protection afforded by the solution. It is therefore important that affordability is considered when setting premium levels such that a sufficient pool of policyholders buy protection to ensure diversification of risk within the mutual.

In the early years of the development of the mutual, diversification benefit is hard to establish as the pool of buyers is limited, so the premium savings may not be as effective as with a developed mutual.

Ultimately with a larger pool of buyers, the benefits of diversification should feed through into lower premiums for the members. However, although this is true for most risks covered by mutuals (fire, hail, property), drought risk is systemic. This is a significant challenge, particularly in Australia where a single drought can affect significant areas of the country. This reduces the opportunity to diversify this key peril across a portfolio and, without the benefit of international reinsurance, the mutual may have insufficient premium funds to cover all its losses.

At a certain size, most mutuals require reinsurance from the international reinsurance market to ensure that any obligations to pay the policyholder members can be met in worst case scenarios. This is particularly important where the mutual is writing risks of a systemic nature or where there in an insufficiently diversified pool of buyers. Reinsurance costs will usually be passed on to farmers through the premiums.

There are a number of ways that government could support a mutual that would lead to lower premium costs to farmers.

Either government could consider capitalising the mutual, reducing the need for reinsurance, or it could act as a reinsurer by providing protection to the mutual if claims exceed premiums. Government could act as the sole reinsurer or could share the risk with private reinsurers. If government can provide protection at terms more economic and consistent than the commercial reinsurance market, this will help reduce and stabilise the premiums offered by the mutual to farmers.

Affinity Model

In this model, farmers receive insurance protection through the commercial relationship that they have with a non-insurance entity. For example, farmers buy a commodity (e.g. grain) and, as part of that purchase, they receive, or are offered, drought insurance. This removes the need for farmers to proactively seek, and separately purchase, drought insurance as it is integrated into the supply chain and marketed to farmers close to the point of purchase of the commodity.

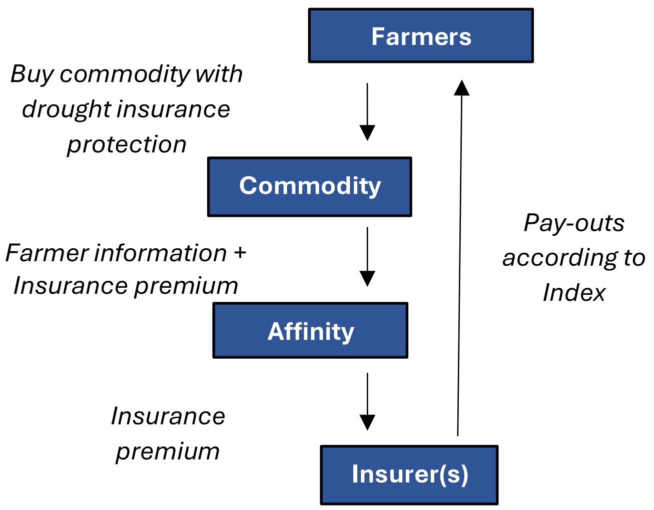

Figure 7 – Affinity model for farmers purchasing insurance.

One potential benefit from using an affinity model is the access to a diverse portfolio of potential buyers through the established relationship between the farmer and the third party.

However, since this is not a mutual model, insurance premiums will be at a commercial rate rather than the potentially lower rate achievable through the mutualisation model.

If the insurance is offered in parametric form, there may also be a level of reputational risk for the affinity provider (for example the commodity provider). This may arise if the farmer is not made fully aware of the basis upon which parametric solutions are triggered and claims calculated, and they feel that they have been mis-sold if they suffer a yield loss and the insurance does not respond.

Finally, there are potential regulatory requirements that need to be considered. Insurance is a heavily regulated industry, and any involvement by a non-regulated entity will need to be properly separated from the sale of the insurance. The financial model that compensates the third party needs to be structured such that it does not inadvertently have them performing regulated activities.

Farm Level Perspective

From a farm-level perspective, the mutual/(re)insurance models presented above will have little to no impact on everyday farming production practices but will improve risk mitigation and drought resilience. If crop insurance is purchased, then farmers will benefit from their crops being covered against drought risk. The impact will be reflected in the price of the insurance and the way in which the farmer accesses the coverage.

Example Parametric Insurance Solution

WTW have modelled an example of a parametric structure to illustrate the likely premium costs assuming a well-diversified portfolio. We have also modelled the impact of reinsurance (risk layering) and various interventions that could be implemented by government.

The illustrative structure assumes that the attachment of the insurance is set such that farmers are protected if state yields fall within the lowest 10% of outcomes. The reinsurance attachment is set at the 1 in 20-year loss, such that it has a 5% probability of being called in any year. These two structures are illustrated below.

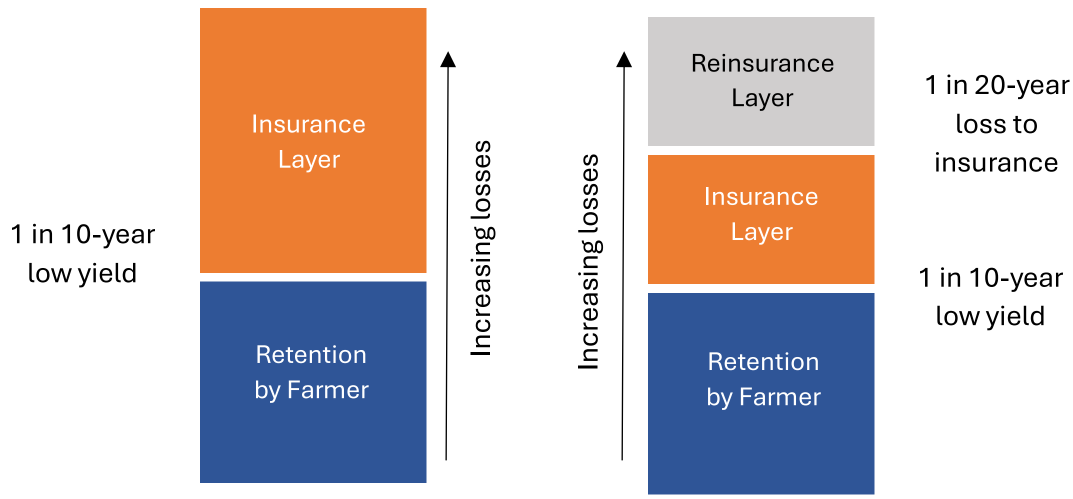

Figure 8 "Insurance towers" for farmers used to understand the overall insurance framework.

The insurance structures that we discuss can be understood by relating losses to "insurance towers" (Figure 8). As described in the Executive Summary, the losses sustained by farmers increases with distance up the tower. The blue boxes show farmer retention, which are losses at levels that the farmer does not receive any pay-out from insurance. The orange boxes above the blue boxes indicate that an "insurance" layer, at which an insurance company pays a farmer, is reached at losses above a certain level at which farmers retain their losses. In our modelling, farmers retain losses relating up to the 1-in-10-year low yield i.e. only in the worst 10% of years should a farmer receive a pay-out from the insurer. The grey box above the insurance layer shows a reinsurance layer, relating to the level of losses at which the insurance company itself buys insurance (so-called "reinsurance"). When the losses reach the reinsurance layer, the insurance company receives a pay-out from a reinsurer. This reinsurance layer attaches at losses for the insurance layer that occur once every 20 years, meaning that the reinsurance company is making a payout, on average, only once every 20 years.

The actual values of the insurance attachment points (based on state yield, in t/ha) and reinsurance attachments (based loss to the insurance programme, in AUD) are calculated based upon the historic yields achieved in each state.

Table 2 – Insurance attachment point for low yield and reinsurance attachment point for cost to the insurance layer.

State	WA	NSW	SA	VIC	QLD	Portfolio
Insurance Attachment (t/ha)	1.74	1.26	1.72	1.86	1.38	According to each state yield
Reinsurance Attachment (AUD)	$17m	$11m	$13m	$6m	$4m	$32m

In order for the insurance scheme to be sustainable, there needs to be sufficient income (from premiums or government support) to pay for the cost of the claims, reinsurance premiums (if applicable), distribution and administration cost and any frictional costs such as taxes. It is also the case that premiums set by insurers will include a volatility loading which reflects the uncertainty in the level of claims. The higher the uncertainty, the higher this loading.

For most insurance schemes the non-loss costs (i.e. those cost which are not directly paid out in claims) can often constitute more than 50% of the premium.

In determining the required level of premium to sustain the scheme, the assumptions made in this model are as follows:

- Risk volatility and capital costs: 20% of the standard deviation of claim payouts for insurance and 10% of the standard deviation of claim payouts for reinsurance.
- Distribution cost: 20% of premium.

- GST: 10% of premium.
- Stamp Duty: 10% of premium (it is noted that this is variable by state, but a flat 10% has been used in the model).

Using these assumptions, we have modelled the "technical" premium that would need to be charged for the portfolio. In reality, the actual premiums may be different, particularly if the take up across each state varies or if the cost or attachment point of the reinsurance changes. Any changes to taxes will also impact the results.

These technical premiums can be reduced by:

- Geographic diversification, i.e. writing the risk as a portfolio rather than on a state-by-state basis.
- Using reinsurance (risk layering) to protect the scheme in extreme scenarios.

The impact of each of these options on the technical premium can be seen below.

Table 3 – The effect of geographic diversification and risk layering on total payable gross premium.

Scenario	Geographic Diversification	Risk Layering	Total Gross Premium (AUD)	Gross premium per tonne insured (AUD)	Gross premium per hectare insured (AUD)	Percentage Reduction
1	No	No	$17.4m	$6.46	$14.86	n/a
2	No	Yes	$16.5m	$6.15	$14.14	5.2%
3	Yes	No	$15.3m	$5.70	$13.10	12.1%
4	Yes	Yes	$14.9m	$5.52	$12.71	14.4%

Scenario 4, which accounts for both geographic diversification and risk layering is the cheapest option out of those presented. This is because large portfolios with geographic diversification of risk have a lower volatility which reduces the loading charged by insurers. Risk layering further takes advantage of the diversification in reinsurance portfolios which extend beyond drought and beyond Australia. By commingling Australian drought risk with risks from other continents, the overall volatility is lower, so the loading applied by reinsurers is often lower than that applied by insurers with a concentrated portfolio. In this scenario, the cost of insurance is approximately $5.52/t, which is 1.58% of the value of wheat. In reality, farmers will have to insure a given area of their farms, and so the value per hectare is also shown, but the results are the same.

There are numerous ways to choose how to split the costs between each state. We redistribute the premium saving according to the premium contribution from each state to ensure that all states receive a premium saving that this is proportional to the premium each state would each individually have to pay.

Table 4 – Potential premium costs and savings for each state between Scenario 2 and Scenario 4.

State	Scenario 2 Each state individually purchases insurance (AUD)	Scenario 4 All states together purchase insurance (AUD)	Saving (AUD)
WA	$4.87m	$4.38m	$490,000
NSW	$4.62m	$4.16m	$460,000
SA	$4.09m	$3.68m	$410,000
VIC	$1.65m	$1.49m	$160,000
QLD	$1.30m	$1.17m	$130,000
Total	$16.5m	$14.9m	$1.6m

Summary of Assumptions

The assumptions made are summarized in the table below. These are high-level and for illustrative purposes.

Table 5 – Summary of modelling assumptions.

Parameter	Assumption
Index	State yield (t/ha) *We have detrended the state yield and adjusted for area planted.*
Attachment	1 in 10-year low yield. ▪ WA: 1.74 t/ha ▪ NSW: 1.26 t/ha ▪ VIC: 1.86 t/ha ▪ SA: 1.72 t/ha ▪ QLD: 1.38 t/ha
Exit	1 in 100-year low yield. ▪ WA: 1.54 t/ha ▪ NSW: 0.94 t/ha

<table>
<tr><td></td><td>▪ VIC: 1.62 t/ha
▪ SA: 1.42 t/ha
▪ QLD: 1.04 t/ha</td></tr>
<tr><td>Tick Value (AUD per tonne)</td><td>$350</td></tr>
<tr><td>Distribution of planted area in each state:</td><td>▪ WA: 4m ha
▪ NSW: 3.6m ha
▪ SA: 2.2m ha.
▪ VIC: 1.1m ha
▪ QLD: 0.8m ha</td></tr>
<tr><td>Take-up</td><td>10% of farmers in each state</td></tr>
<tr><td>Maximum pay-out in each state (AUD)</td><td>▪ WA: $28,000,000
▪ NSW: $40,320,000
▪ SA: $23,100,000
▪ VIC: $9,240,000
▪ QLD: $9,520,000

Note that NSW maximum pay-out is higher than WA because the yield is more volatile in NSW than WA.</td></tr>
<tr><td>Correlation of yield between states
(based on historical data)</td><td>
<table>
<tr><th></th><th>NSW</th><th>WA</th><th>QLD</th><th>VIC</th><th>SA</th></tr>
<tr><td>NSW</td><td></td><td>Medium</td><td>High</td><td>High</td><td>High</td></tr>
<tr><td>WA</td><td>Medium</td><td></td><td>Medium</td><td>Medium</td><td>Medium</td></tr>
<tr><td>QLD</td><td>High</td><td>Medium</td><td></td><td>Low</td><td>Medium</td></tr>
<tr><td>VIC</td><td>High</td><td>Medium</td><td>Low</td><td></td><td>High</td></tr>
<tr><td>SA</td><td>High</td><td>Medium</td><td>Medium</td><td>High</td><td></td></tr>
</table>
</td></tr>
<tr><td>Whole Layer Net Premium</td><td>Annual Average Pay-out + 0.2*Standard Deviation of Pay-outs</td></tr>
<tr><td>Insurance Net Premium</td><td>Annual Average Pay-out + 0.2*Standard Deviation of Pay-outs</td></tr>
<tr><td>Reinsurance attachment point</td><td>1 in 20-year loss to insurance layer</td></tr>
<tr><td>Reinsurance Net Premium</td><td>Annual Average Pay-out + 0.1*Standard Deviation of Pay-outs</td></tr>
<tr><td>Gross Premium</td><td>(1+GST) × (1+Stamp Duty) × Net Premium / (1–Distribution cost)
Distribution cost = 20%
GST = 10%
Stamp Duty = 10%* (*variable by state but modelled as 10% for simplicity)</td></tr>
</table>

Summary and Recommendations

Our analysis concludes that a parametric drought programme determined by soil moisture or rainfall at state level based on yield data (t/ha) reported by ABARES will be most achievable. The policy would be activated based on an agreed measure of drought at the state level. Pay-outs would then be calculated based on state level yield relative to a pre-agreed threshold.

The above model concludes that developing a portfolio solution which includes all states and utilising reinsurance results in a lower cost to the farm business. There are premium savings of around 15% via a national insurance programme with reinsurance, rather than each state purchasing insurance individually without reinsurance.

With a national scheme, Government has a few options on how they can participate; capitalise a mutual model; act as a reinsurer by providing protection to the mutual if claims exceed premiums; act as the sole reinsurer or share the risk with private reinsurers (coinsurance).

The currently active Australian Reinsurance Pool Corporation is a good example of how government acts as a reinsurer. Government could consider extending the Australian Reinsurance Pool Corporation to cover drought risk which would encourage private insurers to participate in a national parametric scheme. Collectively, this would also encourage better reporting of data at farm-level, develop more insights into climate risk and support methods of risk mitigation against drought risk.

Appendix 1: International examples of Expertise

This section provides international examples of impactful industry wide parametric solutions. It also provides some examples of successful models where mutuals and cooperatives have been utilised for distribution or pooling purposes. For clarity of terminology:

- Cooperatives are owned by members who use their services. For example, a purchasing cooperative may help farmers purchase goods and services at a lower cost. These cooperatives may themselves purchase insurance to ensure their own financial protection.

- Mutuals issue insurance policies and are owned by policyholders.

Mutuals and Cooperatives

Co-operative Bulk Handling (CBH) - Australia

CBH Group is a grain handling cooperative owned by its farmer members. Farmers who deliver their grain to CBH become shareholders. Its cooperative structure allows for farmers to pool their resources together to the benefit of its members. In 2011, CBH launched a cost of production insurance scheme which paid out if farmers' actual value of production fell below a pre-agreed level. It only lasted one season due to low take up rates and the lack of yield data at regional level "increased the difficulty in obtaining reinsurance"[10]. This mirrors the concerns raised in our initial data analysis. Insuring farmers in Australia across various states requires strong insurance capacity and access to international reinsurance.

Farmers' Mutual Group (FMG) – New Zealand

FMG is a mutual insurance company with over 50% of the agricultural insurance market share in New Zealand. As a mutual, 100% of its profits go back into the business, benefiting its policyholders. In addition to insuring farming equipment, buildings and vehicles, FMG also insures orchard fruit, arable crops and forestry on a traditional indemnity basis[11]. FMG's portfolio is geographically diverse, covering regions across the North and South Island. According to a report published by the National Farmer's Federation[12], this diversity is particularly beneficial for FMG's "risk management and for reinsurers who support FMG; more affordable reinsurance feeds into better pricing for farmers." FMG is an example of a successful mutual model in New Zealand, acting in the best interest of its farmers and promoting good client retention rates.

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[10] National Rural Advisory Council (2012). Feasibility of agricultural insurance products in Australia for weather-related production risks.

[11] https://www.fmg.co.nz/what-we-cover/fmg-policy-wordings

[12] National Farmers' Federation: On Farm Financial Risk Management Project Sub-Project 3 – Mutuals and Co-operatives (https://nff.org.au/wp-content/uploads/2021/06/Sub-project-3-Mutuals-co-ops.pdf)

Groupama Group – France

Groupama Group is a leading agricultural mutual insurance group in France that covers a wide range of services including crop insurance, agricultural equipment, home, and motor insurance. The subsidiaries of Groupama Group are owned by Groupama Assurances Mutuelles, which is nearly 100% owned by Groupama's regional mutuals[13]. The Group provides coverage for all kinds of crops throughout the country via its regional mutuals. Large crops such as wheat, maize rapeseed, etc., made up 94% of its multi-risk climate insurance portfolio in France as at 31 December 2022[14]. In 2023, Groupama secured a EUR 100m catastrophe bond (a contract that works in much the same way as parametric insurance) for reinsurance protection against weather-related and climate losses[15].

Cooperative purchasing parametric insurance – Australia

WTW was appointed as the parametric insurance broker for a cooperative in Australia. This cooperative was concerned about the impact of low crop yields on its revenue. These yields are heavily impacted by drought. A parametric insurance policy was implemented that responds based on reported grain tonnage from the cooperative. This parametric insurance policy is purchased by a single, large entity and as such benefits from geographic diversification of yields across different regions in Australia.

Mutual offering parametric insurance to farmers – United Kingdom

WTW is the parametric reinsurance broker for a Mutual that is owned by its policyholder members. The Mutual was founded over 100 years ago focussing primarily on agricultural insurance for farmers but has now expanded its services to include to individuals, farmers, and businesses ranging from farm insurance to home insurance. One of the Mutual's policies provides additional coverage options for damage to crops from poor weather. One example is hail coverage which compensates farmers for income loss due to hail damage to arable or horticultural crops. With WTW as the reinsurance broker, the Mutual also provides a unique sugar beet frost insurance policy, which protects sugar beet growers from severe frost events during the harvesting season. This insurance policy has been renewed for over a decade and recently paid out claims due to low temperatures in the UK. This model is successful because claims are made to individual farmers and are based on accurate loss assessments.

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[13] https://www.groupama.com/en/our-governance/the-group-organisation/

[14] GROUPAMA ASSURANCES MUTUELLES 2022. (https://www.groupama.com/app/uploads/2023/04/Groupama_URD_2022.pdf)

[15] https://www.groupama.com/en/analyst/groupama-continues-to-diversify-its-weather-coverage-in-france-with-an-aggregate-catastrophe-bond/

Impactful Parametric Solutions

Parametric solutions have also been impactful for farmers and governments outside of mutuals and cooperative entities. We highlight a few that relate to both farmers and/or governments.

Supporting Reef Resilience with Nitrogen Risk Insurance – Australia (2022)

WTW partnered with Commonwealth Scientific and Industrial Research Organisation (CSIRO) to develop a unique Nitrogen Risk Insurance solution that helps Australian sugarcane farmers avoid loss of yield revenue following lower application of nitrogen fertiliser. Nitrogen Risk Insurance was launched in the 2022 harvesting season[16]. Policies are tailored to specific fields (farmer's location, soil type and crop start) and give farmers flexibility and control over their buying decision. Unlike traditional crop insurance policies where claims are usually assessed on the physical impact of weather events on yield, Nitrogen Risk Insurance claim payments are based on yield outcomes simulated with the APSIM farming systems model using Bureau of Meteorology weather measurements including rainfall, temperature, and solar radiation. The insurance is based on 20+ years of CSIRO's research into sugarcane production. Nitrogen fertiliser reductions facilitated by Nitrogen Risk Insurance have substantial public benefits by reducing the need to fund grants and incentives to achieve improved water quality.

Area Yield Insurance Programme - USA (2020)

WTW designed and executed area-yield index coverage to protect the client's significant exposure to systemic low crop yields. The client is a division of one of the world's largest pharma and crop science companies. As part of its strategy to assist farmer clients to obtain its advanced seeds, the company devised a new pricing model. The pricing model shares production risk with the farmer such that the cost of seed is mitigated if yields are low. The client takes the farm-level risk but, more importantly, a systemic regional risk of low crop production for any reason. Index-based protection protects the client's position, covering six key corn producing States in the US Mid-West. Individual farmers are the initial beneficiaries of the pricing model, and payments are made to the client by reference to benchmark yields per state.

Coral Reef Insurance – Fiji (2024)

WTW collaborated with Fiji's Vatuvara Foundation (VVF) and local insurance broker, Insurance Holdings (Pacific) Pte Ltd, to structure and place a tailor-made insurance solution for a sub-set of the Lau Islands, providing payouts to VVF in case of cyclone damage to the coral reef system and the local communities. The insurance programme enables rapid reef response activities, such as reattaching broken corals and debris clean-up, as well as community assistance activities, such as alleviating food and water security concerns. These activities help prevent the overharvesting and further degradation of the coral reef system and enhance the resilience of the ecosystem and the people. The insurance programme is provided by Pacific Catastrophe Risk

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[16] https://www.wtwco.com/en-nz/news/2023/10/wtw-calls-for-support-for-greater-uptake-of-parametric-insurance-solution-by-queensland

Insurance Company (PCRIC), a development insurer that serves the island communities of the Pacific with innovative parametric insurance products[17].

Parametric Catastrophe Wrapper - Belize (2021)

WTW designed and placed the world's first parametric insurance transaction helping to enable the Government of Belize's ground-breaking debt restructuring for marine conservation[18]. The insurance provides protection to cover Belize's loan repayments after hurricane events. Underwritten by reinsurer Munich Re, the insurance protection played a crucial role in enabling Belize to refinance its sovereign debt under The Nature Conservancy's (TNC) Blue Bonds for Ocean Conservation programme. WTW structured and executed an index-based coverage that responded to objectively defined cyclone and rainfall events. The "catastrophe wrapper" around the 20-year sovereign debt structure strengthens the Government's sustainability and resilience to climate shocks and ultimately, help to preserve the natural resources that many coastal and island nations rely on economically.

[17] https://www.wtwco.com/en-gb/news/2024/02/wtw-launches-first-ever-coral-reef-insurance-policy-in-fiji

[18] https://www.wtwco.com/en-us/news/2021/12/wtw-designs-world-first-parametric-solution-to-help-build-resilience-of-sovereign-borrowers

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