ARC - African Drought Risk Pay-out Benchmarking

Presented by Willis Towers Watson

Industry Background

Over recent years a number of initiatives have been established globally to offer insurance coverage for the protection of government budgets, communities and individuals against the effects of a range of natural hazards in low income economies, where insurance penetration is traditionally low. Prominent examples of such regional sovereign risk transfer programmes include the Caribbean Catastrophe Risk Insurance Facility (CCRIF), the Pacific Catastrophe Risk Insurance Facility (PCRIF) and African Risk Capacity (ARC).

When a disaster strikes it can lead to significant financial burdens which can be felt by several stakeholders i.e. by governments, businesses, and individuals, whether directly or indirectly (World Bank, 2014). A region's economic vulnerability to extreme events will depend on a range of factors. Higher concentrations of people and property in cities or exposed coastal regions, poor development planning, highly inter-dependent, global production processes and the increasing incidence and severity of weather events due to climate change. Each of these factors is contributing to the rising financial impacts of disasters.

In absolute terms, the financial costs are highest for high-income countries, as can currently be seen with Hurricane Harvey's impact on Texas. However, the financial effects of extreme events are much more devastating for middle- and low-income countries. Recurring disasters present a significant challenge to socio-economic development and poverty reduction efforts in those countries. s is too often the case, the poorest communities are the most vulnerable.

A comprehensive risk management strategy is required to prevent and/or limit the economic impact of disasters. Several options exist to mitigate losses. For example, preventive measures, such as land-use planning, enforcement of appropriate building codes, and better construction practices, can be effective. These can be combined with emergency procedure preparedness and development of early warning systems to further reduce the risks.

The decision to invest in such measures should be underpinned by quantification and understanding of the risks. However, despite such risk reduction or avoidance efforts, some residual economic risk will always remain. Risk financing and risk transfer measures provide protection cover and can distribute or pool the residual economic risk. These can be complemented by effective reconstruction plans that aim to reduce future disaster risks and build resilience, after any major event.

Several studies indicate that these *ex-ante* preventive risk-management measures are more cost-effective than post-disaster response and reconstruction crisis-management approaches (Golnaraghi et al., 2016). Furthermore, a number of recent studies indicate that, following a major disaster, countries with lower levels of insurance penetration experience larger declines in economic output and more considerable losses in fiscal strain than those with higher level of insurance penetration (Von Peter *et al*., 2012)

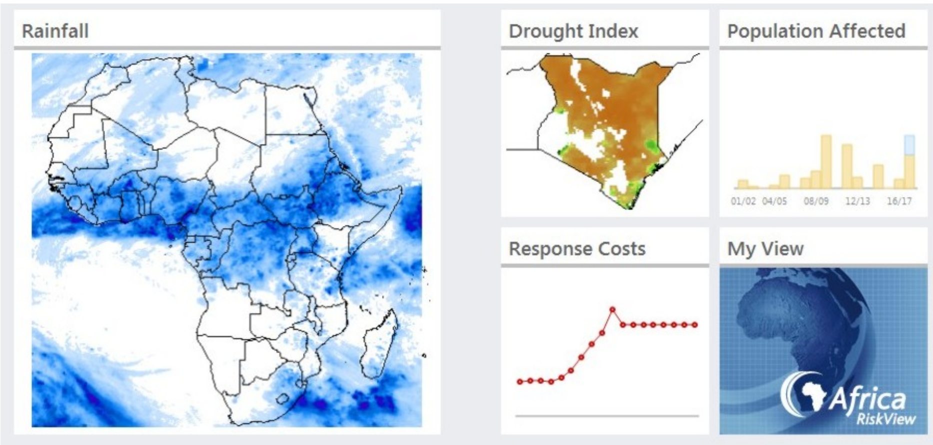
African Risk Capacity (ARC)

ARC (africanriskcapacity.org) was formed in 2014, initially to provide cover against drought to African Countries. Its creation was sponsored by the UN's World Food Programme, operating under the African Union. Like CCRIF, ARC is a mutual insurance company, although countries that provided loans to capitalise the company (UK and Germany) are also members.

Cover is on a parametric index basis offering drought and windstorm policies. ARC Insurance Company Limited has a sister organisation, ARC Agency, which provides African governments with advice on why insurance is required, how its insurance contract should be structured and how to create contingency plans. ARC has 32 member countries with 8 currently buying insurance. 24 reinsurers participate in reinsurance cover, including Lloyd's syndicates.

Africa RiskView models combine existing operational rainfall-based early warning models on agricultural drought with data on vulnerable populations to form a standardised approach for estimating food insecurity response costs. Country-specific customisation and model calibration have been achieved for over ten countries to date by consideration of quantitative and qualitative data such as specific crop types being planted, yield information, and past weather-related disaster events. Four drought insurance pay-outs have been triggered so far over 3 years of operation, with the advantage of such monies being immediately available after an event, greatly enhancing effectiveness of use. For example, in January 2015, Senegal, Niger and Mauritania received an insurance pay out of more than USD 26 million, triggered by the drought in the Sahel, before an international humanitarian aid appeal was made.

The following resource provides further useful background of the role catastrophe re/insurance and examines ARC as a case study: https://www.ucl.ac.uk/rdr/seminars/david-simmons-slides.



African Risk Capacity (ARC) drought and food security modelling

Problem Statement

The Africa RiskView (ARV) model takes satellite-based rainfall data (from two sources: ARC2, with data back to 1983 and RFE2, with data back to 2001) for the whole of sub-Saharan Africa and measures it against the Water Requirement Satisfaction Index (WRSI). The WRSI was developed by the Food and Agriculture Organization (FAO) to determine if a given piece of farmland has received enough rainwater to support its staple crops. The model then factors in the number of people in the area who depend on rain-fed agriculture and their ability to weather a bad harvest to predict how hard a dry spell is likely to hit them.

WRSI benchmarks for each area are calculated based upon each country's chosen benchmark measure (e.g. 5-year median) for each year. The subsequent year's WRSI is then compared to this benchmark to estimate the percentage of population affected, number of population affected and so the response cost per vulnerability area.

An issue exists with the WRSI benchmarks and choice of measure in that phase changes can be seen in climatic data, as with severe drought years in the early 1980s, possibly related to atmospheric teleconnections such as ENSO (El Niño–Southern Oscillation) and Indian Ocean sea surface temperatures (Tadross and Hauser, 2015).

The task is to investigate how the WRSI benchmark should be detrended to account for these climatic phase changes.

- Which WRSI benchmark measure is most appropriate?
    - E.g. 5-year median vs. mean (*n* years) vs. fixed WRSI vs. previous year's value…
- Can the same benchmark measure be reasonably applied to all country-crop combinations?

Data-sets

1)
A Microsoft Excel spreadsheet of Africa RiskView (ARV) modelling (38MB) is available, which includes worksheets:

- 'Growing Seasons' by country by crop
- 'Customized ARV Drought Settings'
    - The parameters agreed with each country for its growing season(s). Used to parameterise ARV and so generate appropriate WRSI numbers for observed rainfall.
- 'RFE2-ARC2 Regressions'
    - Calculation of parameters comparing satellite source ARC2 and RFE2 based WRSI (Water Requirement Satisfaction Index) numbers for the common observed period 2001 to 2015 allowing RFE2 based WRSI numbers to be estimated back to 1983. This exercise is done at a vulnerability area level per season
- 'Vulnerability Area WRSI'
    - Water Requirement Satisfaction Index (WRSI) numbers for each vulnerability area for each year back to 1983, including regressed ARC2 numbers where appropriate
- 'ARV Model'
    - Contains population estimates for each vulnerability area, definitions of sever, medium and mild droughts and response cost per person affected. Benchmarks for each area are calculated based upon each country's chosen benchmark measure (e.g. 5 year median) for each year. Thus the subsequent year's WRSI can be compared to this benchmark to estimate the percentage of population affected, number of population affected and so response cost per vulnerability area.
- 'National ARV Response Costs'
    - Summarises the response cost per year for each country and growing season.
- 'RT Parameters'
    - Details of the drought insurance cover purchased by each country for its growing season(s)
- 'Historical Losses'

    - Pay-outs by ARC are calculated based on the current year's policy terms.
- 'Modelling Parameters'
    - Frequency and severity distributions of the drought response cost used within the stochastic model based upon as-if response costs for 1983 to 2015 when available.
    - Correlation of response costs over the modelling threshold used banded within 20% bands.
- 'Simulated Losses'
    - 20,000 response costs and pay-outs as generated by Willis Towers Watson's iFM model

2)
Original ARV gridded rainfall data (10km grid cell or averaged per administrative zone) may also be available for benchmark detrending considerations.

3)
ENSO (El Niño–Southern Oscillation) climatic data may also be available.

Data Restrictions

One element of the data-sets to be provided is confidential. Any members of the Study Group who have an interest in using that portion of data outside of the workshop week are instructed to contact Willis Towers Watson directly any necessary arrangements regarding non-disclosure so that we can put in place.

References

Golnaraghi, M., Surminski, S., and Schanz, K. (2016). 'An Integrated Approach to Managing Extreme Events and Climate Risks: Towards a Concerted Public-Private Approach: With Recommendations to Harness Potential Contributions of the Insurance Industry', The Geneva Association, Zurich. Available at https://www.genevaassociation.org/media/952146/20160908_ecoben20_final.pdf

Golnaraghi, M., and Khalil, P. (2017). 'The Stakeholder Landscape in Extreme Events and Climate Risk Management,' The Geneva Association, Zurich. Available at: https://www.genevaassociation.org/media/956576/stakeholder-landscape-in-eecr.pdf

Tadross , M. and Hauser, T. (2015) 'Review of Africa-wide regional weather/climate co-variability and associated processes. University of Cape Town, South Africa.

Von Peter, G., von Dahlen, S. and Saxena, S. (2012) 'Unmitigated Disasters? New Evidence on the Macroeconomic Cost of Natural Catastrophes,' BIS Working Papers No. 394, Basel: Bank for International Settlements (BIS). Available at: http://www.bis.org/publ/work394.pdf

World Bank (2014) 'Financial Protection against Natural Disasters: An Operational Framework for Disaster Risk Financing and Insurance. Available at: https://www.gfdrr.org/sites/gfdrr/files/publication/Financial%20Protection%20Against%20Natural%20Disasters.pdf