



Parametric
Insurance:
closing the
protection gap

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Foreword

NIGEL BROOK

PARTNER, CLYDE & CO

Resilience is the ability to bounce back and recover from an event and, from its very inception, the insurance industry has been in the business of helping individuals, businesses and communities build such resilience.

This core purpose remains but the range and nature of the risks facing individuals, businesses and communities is perhaps broader and more complex than it has ever been. All these groups lead more interconnected and interdependent existences due to a range of forces, including technological developments, globalisation, population growth and rapid urbanisation. Meanwhile, weather-related losses are more common and more extreme thanks, at least in part, to man-made climate change.

The insurance industry faces real questions of how to respond to the opportunities and challenges of this changing risk landscape.

The industry is developing many new and innovative ways to mitigate risk for individuals, businesses and communities around the world today. Some of these involve the evolution of traditional insurance models but others are using technology, improved risk modelling and different funding structures to create new

types of cover. One such development is the use of parametric (or index) insurance.

This paper will explore the growth of parametric insurance and consider the important role it has to play in building resilience to natural catastrophes. With parametric triggers having been used in the capital markets for 20 years or more, this paper will explore some of the legal and regulatory challenges and considerations that arise as they are increasingly used in insurance.

The potential of parametric insurance is huge and increasingly well recognised by the industry, governments and end users. This paper sets out to provide additional background and ballast to support the industry as these products develop. One particular benefit of parametric insurance may be its role in helping to address and close the protection gap (the amount of economic loss that isn't insured), which is significant in the developed world and huge in the developing world.

Not only does parametric insurance potentially make insurance cover viable for millions of people, it reasserts the insurance sector's role as central to building resilience around the world.

We hope you enjoy the paper.

INT SURFYNIC



Closing the protection gap

Every year, natural disasters wreak havoc across the world, causing immense harm and destruction wherever they strike. In their wake they leave long-term damage to millions of livelihoods and undermine efforts to build sustainable economic growth. The Bank of International Settlements calculates that in some cases, especially in developing markets, the worst natural catastrophes can permanently reduce a country's GDP by almost 2%.

In 2017, the hurricanes that devastated parts of the US and the Caribbean, the earthquake in Mexico and flooding in Asia emphasised the ever-increasing risk posed by natural catastrophes. Weather-related catastrophes are thought to be increasing in frequency and severity due to climate change. This trend, combined

with population growth and increasing urbanisation, means more people are being impacted more often.

In fact, the number of weather-related loss-events has tripled since the 1980s and inflation-adjusted insurance losses in the same period have increased from an annual average of USD 10 billion to USD 50 billion, according to data from Munich Re. The economic losses caused by natural catastrophes in 2017 look set to be among the worst in recent memory, with Swiss Re data estimating such losses at USD 300 billion in 2017, compared to an average of USD 178 billion for the previous 10 years. With an estimated USD 131 billion of these losses insured, the protection gap is clear.¹

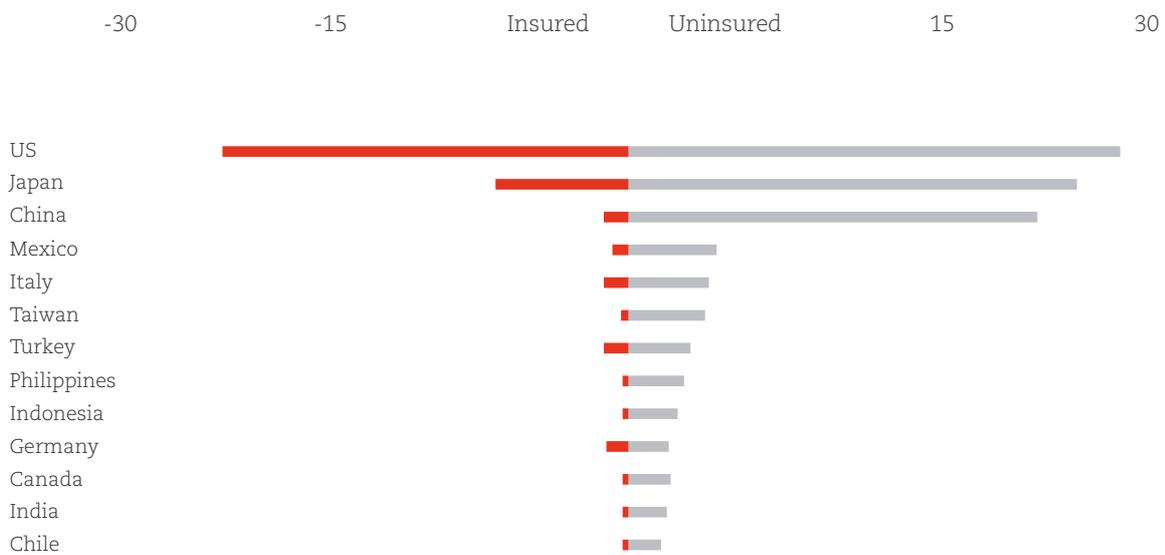
1 Data from Swiss Re Sigma, 20 December 2017. http://www.swissre.com/media/news_releases/nr20171220_sigma_estimates.html

AN ISSUE FOR DEVELOPED AND DEVELOPING MARKETS

The protection gap, which measures the difference between insured and uninsured losses, is an issue all over the world. The protection gap means that individuals, businesses, communities and whole nations are less resilient than they could be if the gap were closed.

Only about 30% of losses from natural catastrophes have been covered by insurance in the past ten years. In middle or low-income countries the uninsured proportion of economic losses often exceeds 90%. This situation is set to get worse. The International Monetary Fund (IMF) has concluded that countries located in the tropics, the vast majority of which have a low GDP, will bear the brunt of more regular weather-related shocks.

Figure 1.1 - Expected insured and uninsured losses from natural catastrophes, 2014, in USD billion²



As the graphic in Figure 1.1 from Swiss Re for 2014 indicates, although the protection gap may be widest in the developing world, its financial impacts are more substantial in the world's economic powerhouses. For example, in absolute terms the US, Japan and China account for the biggest share of the global property protection gap, with expected annual uninsured losses of more than USD 81 billion, which is

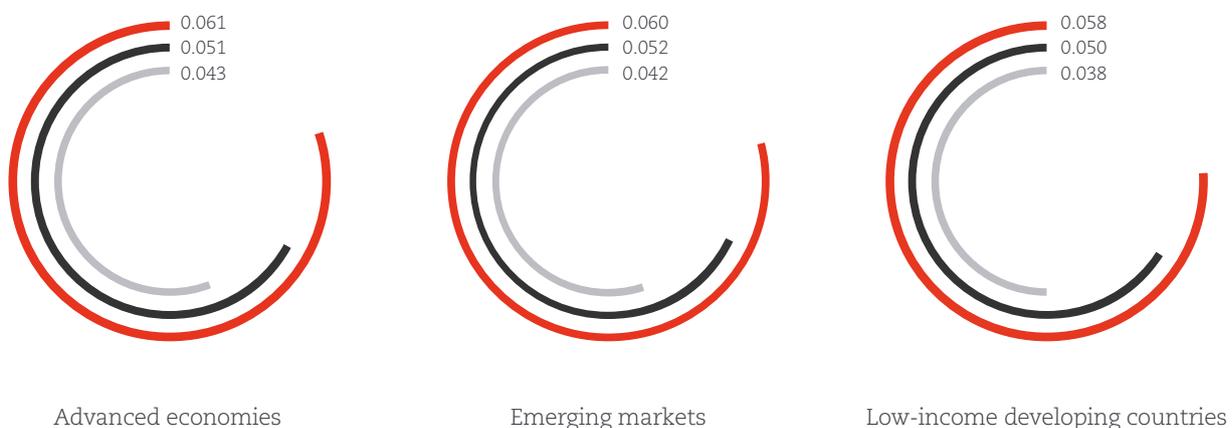
more than two thirds of the total gap of USD 120 billion for the sample countries.³

While developed nations might be better prepared for the rise in extreme weather events, such as tropical cyclones, IMF data shows that they are just as likely to be affected. This makes adequate risk management crucial globally to build resilience and avoid significant negative impact on the global economy.

Figure 1.2 - Rising danger

Tropical cyclone - historical and projected monthly probability of occurrence⁴

- 2010-2014
- 2050
- 2100



² Geneva Association, harnessing technology to narrow the insurance protection gap, source of stats: Swiss Re

³ http://institute.swissre.com/research/library/052015_Underinsurance_of_property_risks_closing_the_gap.html

⁴ International Disaster Database, IMF.

GOVERNMENTS ARE WAKING TO THE POWER OF INSURANCE TO BUILD RESILIENCE

There is a growing international consensus that increased insurance penetration can improve global resilience. Insurance continues to play a unique and vital role in society, as it has done since its foundation, allowing individuals, businesses and communities to rebuild after disaster strikes.

A Lloyd's study in 2012 showed that, in a sample of five large developed and developing economies, a one percent increase in insurance penetration would lead to a reduction in the disaster burden on taxpayers of 22%.⁵ In short, closing the protection gap through appropriately designed insurance solutions can help mitigate the effects of natural catastrophes by enabling communities to get back on their feet quicker and more efficiently.

In the last several years there have been a number of positive initiatives that seek to bridge the global protection gap. In 2015, the G7 launched its InsuResilience

initiative, which aims to deliver climate risk insurance to 400 million of the world's most vulnerable people by 2020. This global partnership has since been expanded to and adopted by the G20 and to the "V20" (a group of 49 nations considered most vulnerable to climate change).

In 2016, the insurance industry, with the support of leaders from the World Bank and the United Nations, formed the Insurance Development Forum (IDF), in which Clyde & Co is involved. The IDF aims to extend the use of insurance and risk management techniques to build greater global resilience.

At the G20 meeting in July 2017, the UK announced the establishment of the London Centre for Global Disaster Protection, in combination with the World Bank, to help developing countries plan for disasters and assess what insurance they might need as part of a risk mitigation strategy. The IDF and the London Centre will provide key platforms for knowledge-sharing and capacity-building to help facilitate the deployment of insurance to contribute to global resilience.

5 <https://www.lloyds.com/news-and-insight/risk-insight/library/understanding-risk/global-underinsurance-report>

PARAMETRIC INSURANCE CAN HELP CLOSE THE GAP

The global protection gap can be narrowed in a number of ways and there is no simple or one-size-fits-all solution. But novel forms of risk transfer hold a lot of potential. Parametric insurance is one of those.

By its nature, parametric insurance brings with it the ability to provide rapid funding for relief, recovery and reconstruction efforts, and so may have the greatest potential impact in countries most dramatically affected by natural perils and where the protection gap is currently large.

Technological developments and improved risk modelling have laid the groundwork to enable the take-up of parametric insurance to accelerate.

The percentage of insurance that employs parametric triggers is growing. Clyde & Co offices around the world – particularly in Asia, Latin America and Africa – are seeing an uptick in requests for policy wording advice and regulatory guidance as parametrics increasingly enter the mainstream of insurers' and reinsurers' product portfolios.



PRAY MANTRIC

The advantages of parametric insurance

WHAT IS PARAMETRIC INSURANCE?

Conventional insurance indemnifies the policyholder for the loss it incurs from an insured event. Parametric insurance by contrast pays a fixed amount upon the occurrence of a triggering event. The amount payable can be based on a modelled forecast of the loss that the policyholder will incur. The nature of the product means that no loss adjusting need take place. As soon as a pre-determined threshold has been met, the policy is triggered and payment is made.

A parametric trigger can be anything, but is often set by reference to a measure of a catastrophic natural event which might lead to a loss or a series of losses. So, for example, hurricane cover might be triggered by wind speeds reaching a certain pre-agreed intensity in a specified location according to a trusted and verifiable provider of weather data. Earthquake cover might be triggered by seismic intensity, location, depth and radius data;

while for drought and agricultural cover the parameters might be based on satellite images of the colour of the ground or volume and frequency of rainfall over defined periods.

Parametric products can cover risks that are not otherwise easily insurable, and allow for more scientific pricing of products that respond to specific isolated parameters, rather than the physical losses which might result from any number of a wide range of occurrences. Together with lower claims management costs, this makes lines of business commercially viable that were not previously.

Data is key with parametrics and, as such, new indices based on datasets are regularly being researched and deployed, including from the Internet of Things (IoT). Provided there is a strong enough correlation between the index and the insured's expected losses, it should be possible to define a parametric solution that offers speed and certainty of payout. Parametric policies are also deployed to build resilience in commercial settings.

For example, there are policies that cover food producers where demand for their produce is weather-sensitive, and providers of renewable energy whose output is reliant on weather conditions. In September 2017, both AXA and Chubb Europe launched parametric policies which automatically pay insureds a fixed sum if their flights are delayed by a certain amount of time. Other policies are available to those involved in logistics and hospitality, and parametric solutions can be used to provide speedy interim payments for business interruption.

Parametric policies can also be offered at a microinsurance level; sold directly to the consumer via mobile technologies, or as an add-on to existing microfinance services. Pioneers in this field include AXA and also Allianz, which in 2015 provided microinsurance to 45 million people in eleven countries in Asia, Africa and Latin America, including some on a parametric basis.

PARAMETRIC INSURANCE OFFERS SPEED AND CERTAINTY

Some key benefits of parametric insurance are speed, certainty of payout and the ability to plan ahead.

These traits are particularly useful in developing countries where it is far more effective to respond before a loss event has turned into a humanitarian and economic crisis, with lives and livelihoods at severe risk and a nation's development potentially put back years. Because parametric payments do not require loss adjusting on the ground, payments can be made quickly to hard-to-reach insureds

in remote locations, often via online payment platforms or through mobile phone networks.

Parametrics are also extremely useful where there are wide-ranging and hard to quantify losses, for example at the national scale. Reflecting this, to date, national and regional governments with shared exposures have led the way in using parametric insurance to distribute funds to member states in a risk pool.

Some of the earliest proponents of parametric insurance were the Caribbean nations which came together after the devastation wreaked by Hurricane Ivan to create a regional risk pool against severe weather, now known as the Caribbean Catastrophic Risk Insurance Facility (CCRIF).

The benefits of parametric insurance have been highlighted in CCRIF's response to hurricanes Irma and Maria where the facility was able to pay out over USD 50 million to member countries such as Dominica, Antigua and Barbuda, and Turks and Caicos within 14 days. In contrast, it is estimated that relief funding from international development partners normally takes between four and 12 months to mobilise.

PREVENTION IS BETTER THAN CURE

The economic benefits of early intervention are clear. The UK's Department for International Development estimates that it would have cost just USD 5 million to contain the 2014 Ebola outbreak when it was first detected in Guinea, potentially stopping the outbreak becoming a pandemic and saving thousands of lives.

Donors ended up giving over USD 7 billion in aid for Ebola response and recovery.

Since then, the World Bank has developed the Pandemic Emergency Financing Facility, covering pandemic risk using an insurance instrument. Payments from the fund are made when certain activation criteria are met based on type of disease, outbreak size, growth and speed. The World Bank estimates that if the fund had existed in 2014 during the Ebola outbreak, the world could have mobilized USD 100 million as early as four months after the outbreak was confirmed and so accelerated the emergency response.

In November 2017, the World Bank announced it would be applying lessons learned from the pandemic facility to address other humanitarian crises.

Another fundamental benefit of parametric insurance for building resilience is that a policy can be triggered not by the calamity itself (such as crop failure or the resulting human impacts), but by its forebear (such as inadequate rainfall), which through funding early intervention can minimise wider human and financial impacts and costs.

For example, one parametric crop policy is triggered on satellite images of grazing land – where a lack of greenery or yellow land indicates the crop is failing. If funds can be made available promptly to a vulnerable region, resources can flow to feed both people and livestock before famine strikes and migration follows.

HOW DO PARAMETRIC DERIVATIVES AND INSURANCE PRODUCTS DIFFER?

Index-based parametric insurance operates in a similar way to certain well-established types of product in the derivatives market, such as weather-based derivatives.

In fact there is an overlap: what is in essence the same instrument can in many cases be framed either as insurance (assuming the customer has an insurable interest, and the provider is authorised as an insurer) or as a derivative. Professionals with the expertise required to model exposure and design a trigger can and do move between the two fields, and a number of insurance groups have divisions that design and issue derivative instruments.

Insurance and derivatives can be used side by side: this is the case with the World Bank's Pandemic Emergency Financing Facility for instance. Alternatively an insurer might issue a parametric insurance policy and hedge its exposure by purchasing a derivative, or pass the risk to the capital markets through Insurance Linked Securities (ILS) products.

OVERCOMING BARRIERS TO ENTRY

As well as being well-suited to building resilience to natural disasters and weather events, parametric products can also help overcome some of the barriers commercial insurers can face when entering new and developing markets.

For example, governments in developing markets may have concerns about international insurers competing with local insurers for standard business. These barriers tend to be less problematic when international players can demonstrate they are offering something unavailable in local markets.

Clyde & Co's research, undertaken by its insurance teams globally, suggests that in many parts of the world regulators and legislators are rapidly getting to

grips with the opportunities presented by parametric insurance. Many regulators are now very amenable to and supportive of their roll-out.

On the supply side, parametric insurance may provide a solution for issues of scalability. It is commercially viable for an insurer to offer crop cover to large-scale industrial farms in, say, the US, France or the UK, where premiums are large enough to cover underwriting and claims management costs. In places such as India, however, where the majority of agriculture is through smallholdings, there are too many small farms and not enough premium income to make traditional models profitable. However, it is now increasingly feasible to cover these farms through parametric policies potentially sold direct to the farmer using microinsurance principles.

PARAMETRIC INSURANCE IN ACTION

Mexico is a pioneer in the use of parametrics. In 1996, the Mexican government created a national fund for natural disasters — FONDEN — to which it transfers budgetary funds for disaster relief and reconstruction efforts. FONDEN uses various financial instruments to support local states and entities in responding to natural disasters, including reserve funds and risk transfer solutions.

In 2006, FONDEN issued a USD 160 million catastrophe bond (called “CatMex”) to transfer Mexico’s earthquake risk to the international capital markets. It was the first parametric cat bond issued by a sovereign.

African Risk Capacity (ARC) was launched by the African Union in 2014. Designed to provide an immediate financial payout to nation state members if there is a drought, the pool started with four countries as policyholders. In October 2017 Sudan joined the ARC bringing the total number of member countries to 22.

Africa RiskView, a bespoke technical engine used by ARC interprets different types of weather data, including rainfall estimates and information about crops, such as soil and cropping calendars. This data is then converted into meaningful indicators for agricultural production and applied to vulnerable populations that depend on rainfall for crops and rangeland for their livelihoods. Africa RiskView then uses this information to estimate how many people may be affected by drought or deficit rainfall in a given season.

At the end of 2015, ARC announced a plan to double its insurance offering through a replica coverage initiative which allows international organisations to take out ARC policies that match those already provided directly to African governments, expanding participating countries’ coverage.

More recently, in 2017, the World Bank developed the Pacific Catastrophic Risk Facility (PCRAFI), a risk insurance pool for five small Pacific islands. The project builds on shared experiences from the similar catastrophe risk pools in Africa and the Caribbean.

1996 - 2004	1996	Mexican government creates FONDEN, a national disaster emergency fund, using a variety of instruments.	2001	Swiss Re issues its first parametrically triggered products covering windstorms in France and hurricanes in Florida and Puerto Rico, plus long series of parametrically triggered cat bond issues between 2001 and 2008.	2003	Swiss Re issues a series of bonds with parametric triggers for a variety of regions. The market grows dramatically.
	1997	Parametric Re provides USD 100 million of cover for Tokyo earthquakes over 7.1. Payout linked level reached above the M7.1 trigger point for defined areas around Tokyo.	2001	Munich Re issues its first parametrically triggered cat bond. PRIME Capital CalQuake & Euro Wind securitises its exposure to earthquakes in California and windstorms in Europe.		Other (mainly Japan-focused) bonds start to use parametric triggers.
	1998	Mitsui Wind and Fire develops event-linked swap based on 7.1 magnitude earthquake parametric trigger.			2004	Parametric triggers make up 44% of all cat bond issuance in the market.
2005 - 2013	2005	Munich Re places Euro 110 million with Aiolos to provide protection against severe Western European windstorms.	2007	Caribbean Catastrophe Risk Insurance Facility (CCRIF) launched as multi-country risk pool.	2012	Insurance leaders and the UN Environment Programme Finance Initiative launches the UNEP FI Principles for Sustainable Insurance. This framework addresses environmental, social and governance risks and opportunities. Signatories include: Allianz, Aviva, AXA, Delta Lloyd, Generali, Mapfre, Munich Re, QBE, Samsung Fire and Marine, Santam, SCOR, Tokio Marine & Nichido Fire Insurance, among others.
		The Hyogo Framework for Action 2005-2015 launched the first global plan to reduce disaster losses.		Midori Ltd bond issued with parametric trigger to cover earthquake risk for East Japan Railway Company.		
	2006	FONDEN issues USD 160 million 'CatMex' cat bond, the first parametric cat bond issued by a sovereign.		Medquake Ltd, bond with parametric trigger to cover severe earthquake risk in Turkey, Greece, Israel, Portugal and Cyprus.	2009	Turkish Catastrophe Insurance Pool (TCIP) issues Bosphorus Re, parametric instrument to protect against regional earthquakes.
		DREWCAT issued by Dominion Resources a US energy and gas company, protects against Gulf of Mexico hurricane risks for its platforms and installations.				Metropolitan Transport Authority of New York issues MetroCat Re bond covering storm surges on a parametric basis.

2014

African Union launches African Risk Capacity (ARC) to payout in the event of a drought across four countries (later joined by Sudan in 2017).

2015

G7 launches InsuResilience initiative to deliver climate risk insurance to 400 million of the world's poorest by 2020.

Allianz provides parametric microinsurance to 45 million people across Asia, Africa and LatAm.

The Sendai Framework for Disaster Risk Reduction 2015-2030 adopted by UN Member States at the Third UN World Conference on Disaster Risk Reduction.

September 2015 Mark Carney, Governor of the Bank of England and Chairman of the Financial Stability Board (FSB) delivers speech at Lloyd's of London - "Breaking the Tragedy of the Horizon – climate change and financial stability".

2016

World Bank, the UN and insurance representatives form the Insurance Development Forum (IDF).

World Bank launches the Pandemic Emergency Fund, supported by Swiss Re.

Kenya launches innovative Kenya Livestock Insurance Program with parametric triggers.

Market Re, developed by Allianz, offers the first parametric instrument offsetting the risks of European warm winters.

Swiss Re launches first parametric insurance programme against natural disaster risks for farmers in China. Covers Heilongjiang province against flood, excessive rain, drought and low temperatures.

2017

UK announces London Centre for Global Disaster Protection.

AXA and Chubb Europe both launch parametric flight delay products.

World Bank develops Pacific Catastrophic Risk Facility (PCRAFI), covering five small Pacific islands.

Atemis BM deal directory sets parametric triggered instruments at 5% of the total market.

Metropolitan Transport Authority of New York issues MetroCat Re bond covering storm surges and earthquakes on a parametric basis.

UK's Financial Conduct Authority brings parametrics into its testing 'sandbox' and puts Floodflash, an even-based flood insurance, into development.

AXA Global Parametrics launched to accelerate the development of parametric products.

UK government backs 'Global Parametrics', a for profit coalition aiming to provide insurance instruments for developing countries.

Philippines establishes first-of-its-kind subnational catastrophic risk insurance program to provide 25 provinces with more than USD 100 million coverage against major typhoons.

IAIS (a global association of national insurance regulators) launches consultation on parametric insurance.

THE GREAT



Legal considerations

If parametric risk transfer solutions are to move from niche to mainstream status as part of (re)insurers' offering in territories around the world, regulators will need to be on side.

Even though parametric insurance has an established track record in many countries, some regulatory and legal uncertainty remains. Parametric insurance products are novel and may not be addressed by statute. Regulatory frameworks that might exist in this area are usually not firmly codified and remain largely untested.

In common law jurisdictions, case law has yet to be established that would inform understanding of how these types of policies will operate, be classified for regulatory purposes and be legally enforced.

Under English law, insurance is a contract whereby for consideration one party promises to pay another if a specified event occurs that is adverse to the interests of the insured. There is nothing within this traditional definition to preclude a contract based on a parametric trigger – the agreed parameters would simply be the arbiter of the “specified event”.

Parametric insurance products may cause legal or regulatory uncertainty in jurisdictions where:

1. the insured must have an ‘insurable interest’ at the time the policy is underwritten and/or at the time the loss occurs.
2. the size of the insurance pay-out must correspond to the actual loss suffered by the insured. This ‘indemnity principle’ can mean that in certain jurisdictions, an insurer may only restore insureds to their pre-loss financial position, such that losses must be valued or assessed before claims can be paid.

RECONCILING INSURABLE INTEREST WITH PAYMENTS TO INTERESTED THIRD PARTIES

Parametric insurance policies are often purchased by sovereigns or sub-sovereigns and are becoming increasingly popular with disaster relief and humanitarian organisations.

Under English law it seems readily arguable that local, regional or even national governments have a direct insurable interest in the effects of a natural disaster on their populations, since without insurance backing they would have to fund the full cost of the disaster recovery from state funds and could be expected to suffer losses in tax revenue, for example.

A non-governmental organisation (NGO) might have plans in place to intervene in a crisis (for example if crops were to fail) even though it is not the NGO itself that is suffering the loss directly. Here the “insurable interest” may be slightly more tenuous, although on balance such a purchaser would likely be able to show a legitimate interest in the cover, rather than it representing a mere speculation. Some jurisdictions

may take a wide view and find an insurable interest of a government in its territory and population or of an NGO in the people and places within its scope of operations.

There are other interesting potential work-arounds.

In China, parametric insurance products providing protection against drought have been arranged collectively at a regional government level, and reinsured by international players.

Protection is then sold at a subsidised premium to individual farmers, who effectively become the policyholders and receive payouts directly.

The farmers themselves clearly have an insurable interest although it is the government purchaser who has arranged and subsidised the insurance as a means of building local resilience within its populace.

DEALING WITH VALUATION ISSUES UNDER THE INDEMNITY PRINCIPLE

English law has long recognised the concept of valued policies whereby the insurer agrees to pay a fixed sum once the loss is established, without a need for further adjustment or valuation at the time of the loss. However, the indemnity principle can potentially create regulatory and legal challenges in jurisdictions where codified insurance law does not traditionally permit 'contingent contracts', requiring instead that any losses are subject to valuation.

In India there has been relatively widespread take-up of parametric products particularly covering agricultural risks such as crop failure due to drought or flood. For example, a number of the larger multinational insurers including AIG, Sompo Canopus and Tokio Marine – in conjunction with their Indian partners – have come together under the umbrella of the Agriculture Insurance Company of India Limited to offer parametric solutions which are generally purchased by farmers as a requirement of their lenders. However, because of Indian regulation and law around contingent contracts, the insured needs to prove to the insurer what the loss

has been. This can, at times, slow down the payment process and thereby somewhat dampens one of the key benefits of parametric cover.

The element of indemnity may also have an impact on how a product is classified, regulated and taxed. The UK Law Commissions note that the main difference between parametric insurance and derivatives seems to be that parametric insurance contracts usually require at least some nominal element of loss before the policy will pay out and that often insurers will require the insured to provide a sworn proof of at least some actual loss.

In South Africa, where parametric insurance is being actively encouraged by a government mandate to provide financial services to the commercial farming sector and to agri-business, an insured must prove they have suffered a loss and that they have an insurable interest in the loss to avoid the cover being classed as a derivative product and regulated as such. Unlike in India, however, insureds in South Africa are not required to quantify the extent of the loss before receiving a payment, merely to prove that some loss has been suffered.

REDUCING BASIS RISK VIA IMPROVED MODELLING

Parametric insurance responds to a trigger (e.g. wind speed exceeds a threshold), and the amount payable depends on the modelled outcome of that trigger. So there is an inherent basis risk: the trigger might not cause loss for the insured; or the loss it incurs might not be what was modelled. Of course, conventional insurance does not always fully indemnify the insured for its loss, but the reason is usually more obvious – for example a retention, limit or exclusion.

Insurance regulators are understandably keen to see that basis risk is minimised, but it can create uncertainty and damage trust in the insurance sector.

Reducing basis risk is particularly important where the policyholder is unsophisticated, or a first-time purchaser of insurance.

Accurate modelling is key to ensuring that any gap between losses experienced and parametric payments is as small as possible.

The African Risk Capacity (ARC) is a world leader in parametric trigger modelling and capacity building with its bespoke Africa RiskView tool. ARC's experience has provided an interesting example of the importance of accurate input data. In 2016, a policy issued to Malawi was not immediately triggered even though there was widespread crop failure. Subsequent investigations by ARC revealed that farmers in Malawi had switched to a different crop with a shorter growing cycle. When this data was put into the model it created a more accurate estimate of the drought-affected population and a payout was triggered.

In time, basis risk may be minimised by more detailed and accurate modelling and greater availability of data. Sophisticated parametric triggers for hurricane risks are now designed to respond to a storm's radius, maximum wind speed, and latitude and longitude at landfall. Another example of innovation in modelling is the Kenya Livestock Insurance Program, supported by the Kenyan government, Swiss Re and the World Bank, which uses satellite images to monitor grazing conditions. When livestock are at risk it delivers parametrically-triggered insurance payments for feed, veterinary medicine and water directly to pastoralists via mobile phones.

The costs of developing better parametric models are also likely to significantly decrease as enabling data and software are increasingly shared as an open resource.

The Oasis Loss Modelling Framework is one example of an open source catastrophe loss modelling platform. NASA's Global Flood Monitoring System provides real-time satellite data and hydrological runoff analysis as an online resource and the OpenQuake Platform allows modelling analysts to share datasets and tools to assess earthquake risk.

LEVERAGING MIXED MODELS

For simplicity and to build trust, parametric insurers might also start off by using simple single datasets as the basis for a parametric trigger instead of more detailed and complex models.

Another possible solution to the basis risk issue is the creation of mixed models.

These are insurance products which have a parametric trigger allowing for immediate emergency funding to be released to a policyholder combined with a normal indemnity function that tops up any additional loss after adjusting.

Such hybrid models are increasingly available and can assist in reducing basis risk and building regulatory and consumer trust for parametric insurance whilst such products are in their infancy. This is particularly the case where there is a strong indemnity principle under local law and losses must eventually be quantified or evaluated.

The CCRIF started with a simple parametric index, which allowed the scheme to be up and in place quickly. After three years, and after more research and model building, it switched to a modelled loss basis that enabled new hazard modules and a variety of exposure database formats to be added.

The FONDEN scheme in Mexico consists of a parametric catastrophe bond to provide immediate post-disaster funding combined with an indemnity-based insurance to cover local governmental assets.



FUTURE

What could the future hold?

Rapid technological advances combined with economic and strategic challenges are prompting the ever-adapting (re)insurance industry to rapidly reshape itself.

Many of Clyde & Co's (re)insurer clients are looking with interest at the opportunities afforded by parametric solutions in both developing and developed markets.

They are assessing how they can combine core industry strengths of data analysis and risk transfer with new opportunities facilitated by fourth industrial revolution technologies – including satellite and IoT data and blockchain-enabled smart contracts.

Parametric products are being rapidly adopted at local, regional and national level as they provide an elegant solution for the risk-transfer concerns, often for populations that were previously uninsured and for whom the protection gap has traditionally been widest.

POSITIVE REGULATORY ATTITUDES KEY

Regulators around the world have a key role to play in encouraging this type of insurance product innovation, which can in turn help to close the protection gap and increase global resilience.

In the UK, the Financial Conduct Authority has brought parametric insurance within its regulatory “sandbox”. For example, Floodflash – an event-based flood insurance – is currently in its development stage and was selected as part of 2017 Cohort 2 of the regulatory sandbox in June 2017. Floodflash is designed to pay a pre-agreed settlement as soon as the company’s sensor detects that flood waters have exceeded a certain depth: essentially a parametric trigger with a direct, local dataset directly reflecting the experience on the ground.

In China all parametric insurance products must currently be approved by the regulator on a case-by-case basis. However,

we understand that parametric insurance regulations are in development which will speed adoption of parametric products. Meanwhile the Chinese government is in the process of setting up the Shanghai Insurance Exchange to facilitate access to agricultural insurance products including those that utilise parametric triggers. Although it is relatively early days, it is hoped that the exchange will become a hub for (re)insurers and an important platform for risk transfer.

Meanwhile, Singapore is not especially vulnerable to natural disasters and does not have an extensive agricultural industry, so is unlikely to invest itself in many of the currently available parametric products, however it is a logical place for a regional insurer to set up operations and take advantage of an open and flexible regulatory environment. For example, the insurtech start-up, Asia Risk Transfer Solutions has set up operations in Singapore with the aim of providing disaster protection solutions, including parametric insurance, to people and businesses in China and India.

INNOVATING FOR SUCCESS

Commercial enterprises are also innovating in this area, building capacity and driving an increase in technological know-how. For example, Global Parametrics, a parametric risk transfer provider backed by a third-party capitalised risk fund, the German government and the UK's Department for International Development, was launched last year. Its aim is to help increase penetration of insurance coverage for weather, catastrophes and natural disasters, by targeting clients and populations that currently do not have this type of protection.

In March 2017 French insurance giant AXA announced the launch of AXA Global Parametrics. Having been focused on parametrics since 2014, AXA now has a dedicated parametric insurance department and has developed expertise in climate risks and worked with many different actors in various sectors across the world including weather-sensitive corporates in agriculture, renewable energy, construction, transportation, leisure and textile businesses, as well as with international institutions and governments.

While parametric products develop, both for commercial purposes and for national and regional level disaster protection, their shape, scope and application are likely to evolve further - finding new risks that are currently uninsurable which they can

make commercially viable, or appealing to donors and state actors as part of risk mitigation strategies.

Likewise, how parametric products are treated in the law and by regulators will also evolve and become clearer as case law and precedent develops.

However, with the amount of support from governments around the world, demand from buyers and the proven success of parametric insurance products, it is to be hoped and expected regulators and law makers will support and encourage the responsible roll-out of parametric insurance rather than attempt to hold it back.

Reflecting the growing international interest in the regulatory and legal landscape for such products, the International Association of Insurance Supervisors (IAIS) issued a draft issues paper on index-based insurances in November 2017 discussing some key issues surrounding insurable interest, accurate modelling, and consumer protections.

With support and increased understanding, parametric insurance can fulfill its wide-ranging potential and, alongside traditional insurance and other novel forms of risk transfer, play a key part in closing the protection gap and strengthening global resilience.

KEY FACTORS FOR SUCCESS

With the potential of parametric insurance clear, the appetite proven and products already in the market and working on a government backed and commercial basis, what, bearing in mind the legal and regulatory issues raised in this paper, are the key factors for success?

1. Basis risk will need to be mitigated through careful and accurate modelling. Product design, wording and careful consideration of alternative scenarios, captured in contractual terms are vital.
2. A key part of modelling is accurate and reliable local information and know-how to conform the triggers and calculations of pre-modelled loss as closely as possible to actual

loss experience. Such accuracy will build trust for these innovative products (and the insurance industry more generally) where insurance penetration is traditionally low.

3. Mixed or hybrid models with parametric and indemnity elements combined are available and can assist in building regulatory trust, particularly where there is a strong indemnity principle under local law and losses must eventually be quantified or evaluated.
4. All parties involved with parametric products must understand how the cover works. Clarity and communication with the buyer, and with regulators and others will ensure that parametric products build a name for themselves and fulfil their promise in improving global resilience.

Clyde & Co and resilience

As a leading insurance law firm, Clyde & Co is committed to supporting initiatives that facilitate greater resilience in the developed and developing world. In the wake of increasing climate related events and societal trends such as urbanisation, the challenges facing insurers in trying to provide the best protection cover to corporates, governments and communities, are considerable.

Globalisation has raised resilience management to the top of the corporate agenda and commerce and populations need the experienced support of the insurance industry to adapt to the disruptive forces driving the protection gap. Insurance products such as parametric and microinsurance, assisted by advancements in assessment tools and data management, will play an increasingly active role in resilience management. These innovative new, mixed and hybrid insurance products

are evolving, but as ever the regulatory framework will have to move fast to keep up. In these circumstances strong and experienced legal support is essential.

Clyde & Co has the largest team of insurance and reinsurance law specialists offering a global service across every insurance business class. Through our global network we can provide local and London market legal and regulatory advice from concept to final product supporting new insurance approaches, market expansion strategies, structural policy decisions, regulatory familiarisation and duties of care advice. Our track record of supporting insurers in new and emerging markets is second to none and our support of institutions working to create a more resilient world means we remain focused on supporting the development of resilience management expertise across the world.

Contacts

UK & EUROPE



Nigel Brook
Partner, Clyde & Co
T +44 (0) 20 7876 4414
E nigel.brook@clydeco.com



William Hogarth
Legal Director, Clyde & Co
T +44 (0) 20 7876 4289
E william.hogarth@clydeco.com

AFRICA



Emie Van Der Vyver
Partner, Clyde & Co
T +2 710 286 0326
E emie.vandervyver@clydeco.com

THE AMERICAS



Vikram Sidhu
Partner, Clyde & Co
T +1 212 702 6773
E vikram.sidhu@clydeco.us

AUSTRALIA



Dean Carrigan
Partner, Clyde & Co
T +61 2 9210 4401
E dean.carrigan@clydeco.com

SINGAPORE



Ian Stewart
Partner, Clyde & Co
T +65 6544 6534
E ian.stewart@clydeco.com

With thanks to the following Clyde & Co contributors in the compilation of this report:

Nigel Brook
William Hogarth
Wynne Lawrence
Yannis Samothrakis
Paul Lowrie
Vikram Sidhu
Peter Whalen
Sumeet Lall

Ian Stewart
Dean Carrigan
Michael Cripps
Xiaolin Lin
Ernie van der Vyver
Kankiza Tibajuka
Stirling Leech



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