RESEARCH NOTE

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CATASTROPHE RISK – THE DISASTER GAP AND THE ECONOMIC CASE FOR INSURANCE LINKED SECURITIES

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WHAT IF?

Just as this paper was going to print, Hurricane Matthew formed in the Atlantic Ocean. After the utter devastation wrought on Haiti, all eyes were on the path it would take up along the East Coast of the USA. While briefly reaching the maximum (Category 5) strength, a different path could have resulted in a very different outcome.

If Hurricane Matthew had hit the most concentrated property exposures of Miami head on, the insured losses could have exceeded $250 billion[1]. Comparing that figure to the reinsurance industry's capital base of only $350 billion suggests a gross under-preparedness to meet the cost of catastrophic disasters.

Insurance Linked Securities (ILS) have been created as part of the solution to this Disaster Gap problem. In return for providing structural capital to set against the possibility of extremely rare but damaging catastrophes, investors are rewarded with attractive risk-adjusted returns.

A specialist segment of the investment management industry has developed the expertise to model and price ILS fairly and accurately so as to construct an asset class which offers yield driven returns above commensurate levels of risk. The key reason for including the asset class within broadly diversified portfolios is that ILS have a fundamentally different set of return drivers than traditional assets.

In return for accepting a share of the Disaster Gap solution, investors can add to portfolios an asset class which in its own right produces an attractive risk adjusted return, while also adding the benefit of genuine diversification from more traditional return sources.

Surprisingly Insurance Linked Securities do not rate a mention within the fashionable category of 'impact investments'[2]. Yet by helping to close the Disaster Gap they have a measureable beneficial impact on the quality of people's lives *and* generate attractive risk-adjusted returns

1. Unless expressly stated otherwise, all monetary figures are referenced in US dollars.
2. Impact investments are typically defined as those investments intended to generate both a measurable beneficial or social impact and an adequate financial return.

INTRODUCTION

There are two glaring shortcomings in the global readiness to deal with the costs of a catastrophic disaster. First is the difference between the expected 'economic' losses and the known 'insured' losses exposed to these events. Second is the gap between the total global re/insurance[3] coverage and the estimated total claims following a major disaster. This so-called Disaster Gap is large and growing.

Where insurance does not completely cover the costs associated with a catastrophe, the resulting Disaster Gap must be funded by governments and ultimately tax payers. This presents challenges for governments while the solution presents opportunities for investors.

A recent Australian event illustrates the Disaster Gap dilemma. Coming up to six years ago in December 2010 and January 2011 a protracted series of rain events throughout Queensland led to the inundation of Brisbane and state-wide flooding of historical proportions. More than 78% of the state was declared a disaster zone and 29,000 homes and businesses, as well as 2.5 million people were directly affected.[4]

With additional damage from Cyclone Yasi on the 2nd of February, the combined cost of repair and reconstruction of state infrastructure was estimated at $A5.8 billion.[5] These public assets were completely self-insured, meaning not insured. The Disaster Gap was 100%. In response, the Federal Government announced a number of measures to assist the rebuilding effort that included cuts to budget spending, delaying certain infrastructure projects and a national 'flood levy' on Australian tax payers.

UNDERSTANDING THE DISASTER GAP

Why do so many people choose to live in disaster prone areas? It is a question often asked, but the answer lies not within the context of irrational risk-taking behaviour, but rather in the context of economic imperatives which create concentrations of wealth and property.

Half of the world's GDP is generated on 1.5% of its land mass[6]. Production tends to concentrate in big cities and in wealthy nations, a concentration of resources that is efficient. The more units of economic production concentrated into the same area, the greater the economic benefit and level of wealth creation.

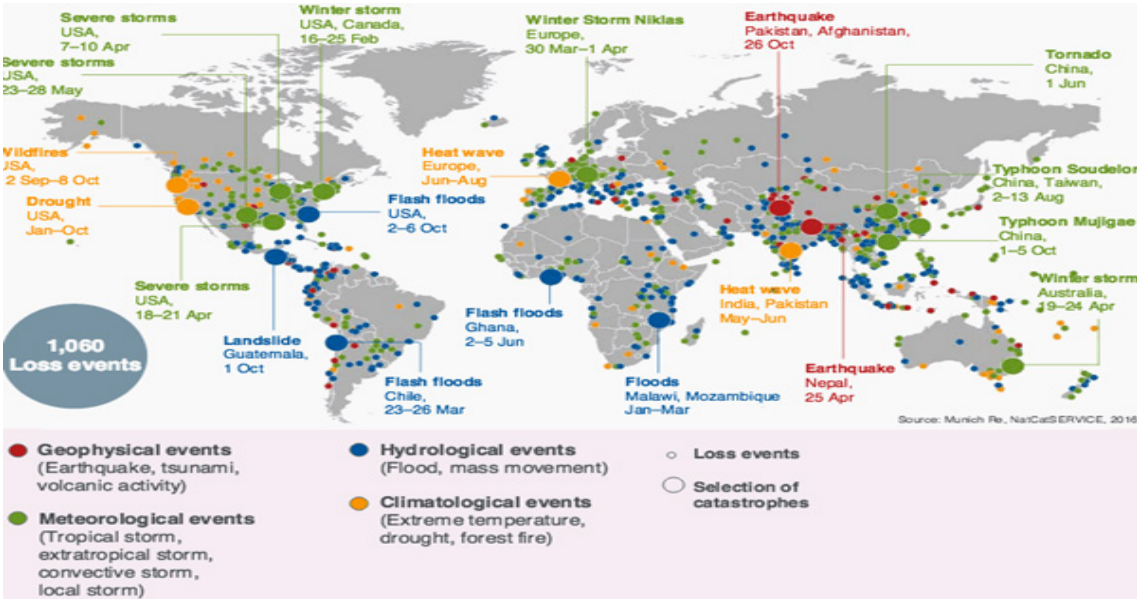
According to Moore's 'Law' the number of transistors able to be embedded in computer chips doubles roughly every two years. Global population centres have followed a similar 'law' in which the density of major cities doubles roughly every 10 years, leading to the high level of economic concentration cited by the World Bank. A country's GDP growth is not spread evenly across the nation, it is concentrated within the major cities.

Most major centres of production are located on or near coastlines so the historical reliance on shipping as the most efficient over-ocean transport system has continued into the modern age. It follows that these centres of productive concentration are prone to hurricanes and typhoons which form only over oceans. Many of these areas also lie within earthquake zones and probably owe their very existence to ancient quake activity which created the deepwater harbours conducive to heavy

3. Throughout this paper, the term 're/insurance' refers to the combined activities of insurance and re-insurance
4. Queensland Floods Commission of Inquiry Final Report, March 2012
5. Operation Queenslander, The State Community Economic and Environmental Recovery and Reconstruction Plan 2011-2013
6. World Development Report 2009, 'Reshaping Economic Geography', The International Bank for Reconstruction and Development/ The World Bank, 2009

shipping. Examples of such ports include: Shanghai and Shengzhen, the world's two largest, as well as better known examples in San Francisco and Kobe.

Natural catastrophes happen often. In 2015 over 1000 events caused a notable level of loss to insurance companies. (See Chart 1). Catastrophes are most devastating, in a purely economic sense, when they occur in major centres of economic production and wealth concentration.



Source: Munich Re

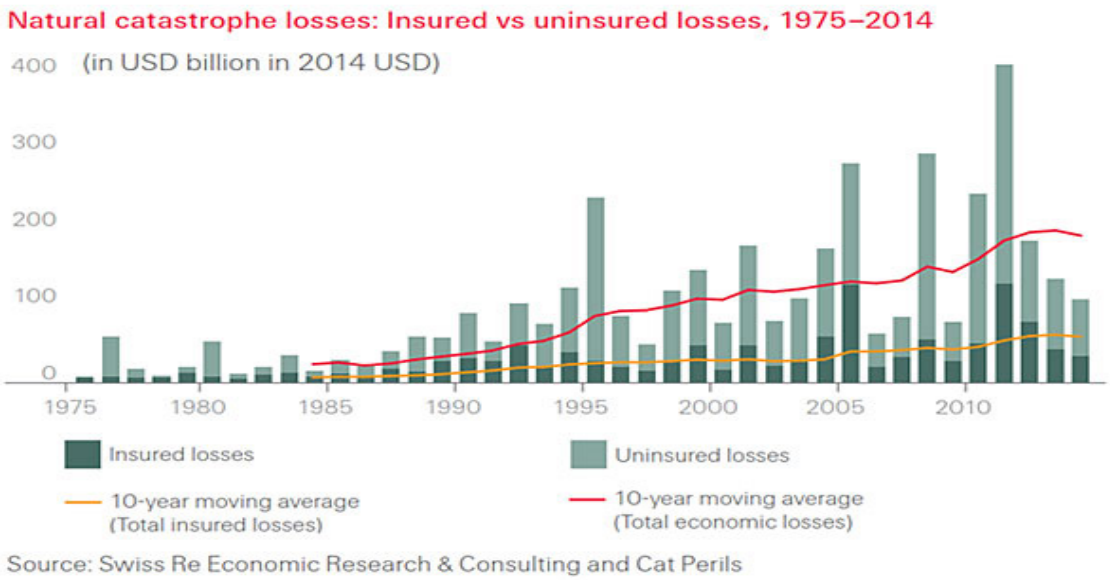
The first building block in understanding the Disaster Gap is the recognition that rational economic activity produces increasing concentrations of wealth and property. A catastrophe in one of these major cities will cause a much greater economic loss than a similar event elsewhere.

ECONOMIC VS INSURED LOSS

Whenever a major catastrophe is reported in the media, typically two loss estimate figures are quoted: the economic loss and the insured loss. Economic loss means the total cost to the economy from the disaster. Insured loss is that component of economic loss that is covered by insurance. The primary factor which determines the difference between the two is the level of insurance penetration. The greater the level of insurance penetration, the more property is covered for losses and, consequently, the smaller the difference between economic and insured loss.

Swiss Re estimates the gap between economic and insured losses over the 10 years to 2014 to have grown to $1.3 trillion[7]. The implication is that around 70% of the total losses from catastrophes are borne by individuals, corporations and governments, rather than by insurance.

7. 'The USD 1.3 trillion disaster protection gap,' Swiss RE, October 2015



In emerging economies and countries with an under-developed insurance market, the gap is more pronounced than in developed countries. For example, in 2015, catastrophes in China cost that country's economy $41 billion with an estimated 4% of the economic loss figure covered by re/insurance[8].

Without adequate insurance coverage, governments are placed under enormous pressure to fund disaster recovery, help their citizens and rebuild lost infrastructure. The impact on domestic GDP can be significant.

The table below compares the impact of similar earthquakes in Haiti (2010) and New Zealand (2010-11), bringing into stark contrast the impact a natural catastrophe can have on a country with and without insurance coverage.

	Haiti	New Zealand
Total GDP (USD)	6.6 billion	164.7 billion
Earthquake Magnitude	7.0	7.0
Economic Loss (USD)	8.5 billion	31 billion
Insurance Coverage	<1%	80%
Economic Loss/GDP	120%	18%

Source: Swiss Re[9]

In the aftermath of the Haiti earthquake, that country's GDP growth fell from +3.1% to –5.1% in 2010[10].

This is not only an emerging economy phenomena. The response to the Queensland floods of 2011 produced a practical example of the impact of underinsurance on the local economy. The need to adjust government budgets, issue debt and raise taxes, are the tools available to rebuild in the absence of adequate insurance coverage. Donor aid makes up the fourth pillar of post-disaster recovery mechanisms.

8. Artemis, January 14, 2016
9. 'Closing the protection Gap, Disaster risk financing: Smart Solutions for the public sector,' Swiss Re, 2015
10. ibid

Some of the impacts to the Australian economy attributable to the 2011 floods included:

1. Federal funding of over $A2 billion under the National Disaster Relief and Recovery Arrangements (NDRRA)[11]
2. Estimated reduction in national real GDP of between 0.25% and 0.5% for the 2011/12 year[12]
3. Imposition of a Federal tax levy on most Australian taxpayers[13]

As a general rule, the larger the gap between insured losses and economic losses the greater the impact on that country's economy and its citizens.

THE STRUCTURAL DISASTER GAP

Is "insured" really "covered"?

There is a growing gap between insured and uninsured losses for catastrophe events[14]. While the trend is worrying enough, of greater concern is the existing loss exposure to a so called 'mega-catastrophe', the likes of which the modern insurance industry has never seen.

Through modelling of:

i. the increasing density of property within major cities;
ii. rising costs of rebuilding; and
iii. known level of insurance coverage.

The re/insurance industry has developed a deep understanding of the potential exposure to a major event. Currently, the industry standard point of reference for this 'mega-catastrophe' is the 1:200yr insured event. A 1:200yr event translates into a probability of 0.5% of occurrence in any given year. It is a remote probability[15] but far from unfeasible.

A point of clarification: The 1:200yr insured event refers to a loss to the insurance industry that is expected to occur with a probability of 0.5% p.a. It does not infer a 1:200yr storm or similarly rare earthquake occurrence. Every year somewhere around the world, there are numerous natural catastrophes of a magnitude great enough to cause a 1:200yr insured loss. But with so much of the world's productive capacity concentrated in such a small area, the placement of such an event in precisely the right (or rather, wrong) location, is a rarity.

With these models the insurance industry can estimate the expected physical losses from relatively regular natural events, out to rare and extremely rare scenarios. Modelling expected losses is an important function in any risk management process. Banks stress test balance sheets to varying degrees of financial and economic shocks as do investors who test their portfolios against market volatility scenarios.

On the other side of the loss (liability) side of the equation, each insurance industry participant knows precisely how much it has in assets: the combination of its own balance sheet and reinsurance coverage. Traditionally, insurance companies have purchased their own insurance from reinsurance companies in order to meet the capital requirements, set formally by regulators and informally by ratings agencies, to cover the liabilities written through insurance policies.

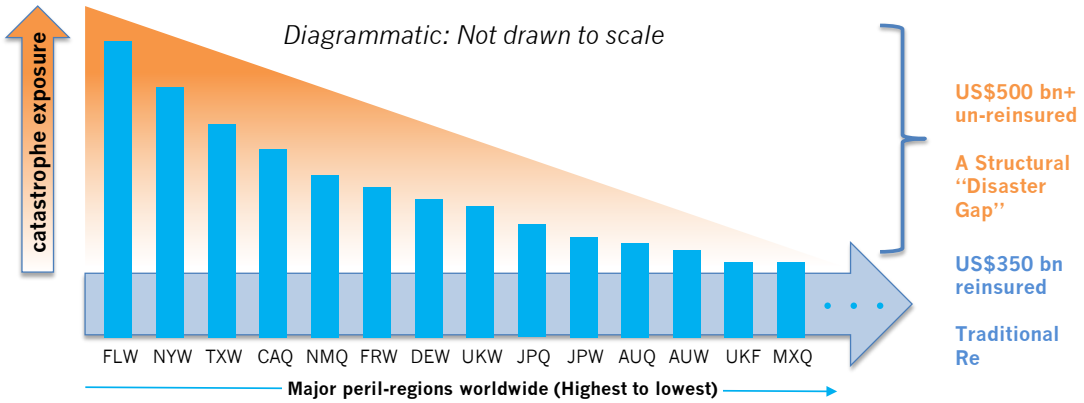
11. Queensland Reconstruction Authority Annual Report 2011-2012
12. Executive Minute: Preliminary Budget Impact of Current Flood Crisis in QLD & NSW, 12 January 2011
13. The 'Temporary Flood and Cyclone Reconstruction Levy' applied to most taxpayers for the 2011/12 income year
14. See footnote 6
15. The 1:200 probability is slightly more than the probability of a coin toss exercise producing eight consecutive heads

There are catastrophic scenarios in which global insurance company balance sheet assets and reinsurance capital are severely depleted and many insurers could be completely bankrupted. Further, to the extent that the aggregate capital providing cover is exceeded by the total losses, governments, taxpayers and society in general would bear the total excess, whether directly or indirectly.

The current estimate of the 1:200yr insured loss from a hurricane hitting a major city such as Miami would today cost the industry up to or exceeding $250 billion[16]. At the same time, the total capital base of the traditional reinsurance industry is estimated at a little under $350 billion[17]. Although the reinsurance capital base is not all exposed to this single event, a 1:200yr event would throw the global re/insurance market into disarray. While rated as a 1:20yr event, Hurricane Katrina in 2005 resulted in only $40bn[18] of insured loss and yet caused unexpected insurer and reinsurer insolvencies. These insolvencies compelled insurance regulators and ratings agencies to increase significantly the amount of capital required for both insurers and reinsurers to continue to operate, which in turn increased the overall cost of insurance worldwide.

It is reasonable to expect therefore, that a $250bn, 1:200yr event loss would have a significant and drastic impact on not only the population locally affected, but on the entire global cost of insurance. Because of both the significant destruction of re/insurance capital as well as the inevitable regulatory response to re/insurer insolvencies, an Australian home owner, for example, might well pay more for property insurance even though the event affected the other side of the globe.

The chart below, produced by Fermat Capital Management, presents a schematic view of the structural component of the Disaster Gap.[19]



The total global reinsurance capacity of $350 billion is spread roughly equally across peril exposures. Put another way, the amount of reinsurance capital available for any given peril is capped at roughly $20 to 30 billion. The difference between the $20 to $30 billion of reinsurance coverage and the estimated $250 billion cost of a 1:200yr Florida Wind event represents the first, and largest, piece of the Disaster Gap.

The orange triangle in the above chart reflects an estimated $500bn+ structural Disaster Gap between the traditional reinsurance capital base and the global exposure to catastrophe risk. This

16. Increasing Concentrations of Property Values and Catastrophe Risk in the US, Karen Clark & Company, April 2015
17. As of January 2016, Guy Carpenter estimates that global reinsurance capital is $400 billion, of which 83% was traditional reinsurance capital
18. Source: Property Claims Services (PCS®), a Verisk Analytics® business
19. FLW – Florida hurricane, NYW – New York hurricane, TXW – Texas region hurricane, CAQ – California earthquake, NMQ – New Mexico earthquake, FRW – France windstorm, DEW – Germany windstorm, UKW – UK windstorm, JPQ – Japanese earthquake, JPW – Japanese typhoon, AUQ – Australian earthquake, AUW – Australian typhoon, UKF – UK flood, MXQ – Mexico earthquake

exposure can be broken down approximately into the following categories:

- $200 billion insured, but not reinsured, by the private market
- $150 billion effectively insured by governments
- $150 billion uninsured exposures

Without a functioning insurance industry, the world economy would be severely affected: buildings and infrastructure could not be built, banks could not lend or take deposits and businesses could not operate. A large enough catastrophe could severely affect the global economy, not by directly destroying its economic capacity, but rather by choking off access to adequate insurance; a pre-requisite for doing business.

CLOSING THE GAP – THE ROLE OF CAPITAL MARKETS

The insurance industry needs additional capital to meet the growing gap between insured coverage and the expected losses from potentially devastating and highly remote catastrophes. Whereas companies in the past would have considered issuing new equity or debt, or purchasing additional reinsurance, the problem is bigger than the re/insurance industry can solve within itself.

With traditional re/insurance management lines all but capped out, the structural Disaster Gap requires a structural solution.

The total value of the global listed equity market stood at approximately $62 trillion at the end of 2015.[20] The total global Disaster Gap represents approximately 0.8% of this. It is clear that the global capital market has the capacity to assume the Disaster Gap risk with relative ease. The risk can be passed to stronger hands.

A capital markets solution requires these key features:

- A robust mechanism or instrument in which to execute and potentially trade investments
- The ability to assess and quantify the risk of investment; and
- An adequate return on invested capital

THE ROLE OF INSURANCE LINKED SECURITIES (ILS)

The need for a capital markets solution to help solve the Disaster Gap problem has driven innovation and the development of a number of structures, grouped under the title “Insurance Linked Securities (ILS).” Some of the better known subsets of ILS include: collateralised reinsurance contracts, Industry Loss Warranties and Catastrophe Bonds.

These instruments are not the same as traditional reinsurance. In fact the industry needs little additional capital to effectively operate in the normal course of business, the way it has always done. Relatively high frequency/moderate loss events drive the cyclical market for re/insurance. ILS exist primarily to assist with the aftermath of very low frequency/extreme loss scenarios. These represent not cyclical, but rather structural, extreme tail risks.

In return for accepting a share of well modelled risk exposures, investors can add to portfolios an asset class which in its own right produces an attractive risk-adjusted return, with the added benefit of genuine diversification from more traditional assets. ILS typically carry a similar level of risk to

20. World Bank data, "Market Capitalisation of Listed Domestic Companies"

equity or high yield debt with returns that are as adequate as and often greater than their credit related equivalents.

The ILS solution offers investors a structural return related to the equity cost of capital of the re/insurance industry, with an inherently stable yield in the absence of a major catastrophe.

CONCLUSION

The Disaster Gap is a large funding mismatch between the capital base of the re/insurance industry and the forecast losses from extremely rare natural catastrophe tail events. Without reducing this global liability, the recovery bill falls directly to affected nations, their governments and, ultimately, its citizens. Failure to deal with the growing Disaster Gap will, at some point, severely affect the global re/insurance pool with a potentially devastating impact on the world's ability to do business.

The need for a capital markets solution has seen the development of the ILS asset class, which continues to go some way to closing the Disaster Gap. In return for providing investors with attractive risk-adjusted returns, ILS represent a valuable and growing source of structural capital solution to the world problem.

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