A Primer on Financial Risk from Natural Disasters: The Case for Public-Private Collaboration

IBC BAC

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Executive Summary

Economic recovery from natural disasters relies upon effective and timely collaboration between governments and the private sector. Effective recovery is driven by the restoration of consumer and business confidence and is best achieved through fiscal planning before the event takes place. This paper provides a primer on the private disaster risk market and is designed to provide government officials with an understanding of how the private market functions in this area. Furthermore, it illustrates how a public-private partnership – built on the strengths of both the government and the private insurance industry – would reduce the economic and fiscal costs of disasters and is the only viable long-term solution to help Canadians recover financially from a significant catastrophe.

Section 1 explains concepts of disaster risk and the evolving nature of the private market in Canada. It details the structural limits of the private flood and earthquake insurance markets in Canada and the impact of those limits on consumers, governments and insurers. As we will discuss, gaps in today's market for disaster insurance leave Canadian governments and taxpayers bearing a growing share of the financial cost of disasters.

Section 2 illustrates how the private and public sectors can collaborate to address these limits – specifically how public-private risk-sharing can address gaps in disaster insurance markets.

Section 3 reviews public-private risk sharing systems in other countries to demonstrate the efficacy of this approach in mitigating the financial impact of disasters on governments, taxpayers and consumers.

Section 4 reflects on international lessons learned that can be applied to the flood and earthquake insurance markets in Canada. Unfortunately, many of these countries put correct measures in place only after a major disaster. Canada has the opportunity to learn from international best practices and take steps to protect its citizens using foresight rather than hindsight to define appropriate roles within an effective public-private partnership.

1 – The State of Disaster Insurance in Canada

Canada is exposed to many natural hazards that have the potential to harm its citizens and communities. Large disasters – particularly floods and earthquakes – take a severe human toll worldwide every year. Lives are lost, and homes and businesses are destroyed. Following such events, local, regional and national economies can suffer consequences for years.[1]

The most common natural disasters in Canada are floods, which, historically, have also been the most costly. The least common are earthquakes, which have the potential to be the most costly. Although Canada has not experienced a major earthquake in a long time, science tells us the odds are against us – there's a 30% probability of a major earthquake striking Canada anytime over the next 50 years.[2] And when the "Big One" comes, it will be the costliest natural disaster the country has ever faced.

In Canada, private disaster insurance is widely available for most hazards. Most home insurance policies cover wind, hail, fire and basic water damage. However, most standard policies do not cover flood or earthquake. These two perils present significant challenges to the private insurance market in Canada, which in turn pose a major risk to Canadians.

These challenges are due to features intrinsic to disaster insurance markets that make the insurance coverage naturally expensive (see **Sidebar: The economics of disaster insurance**). In the case of flood risk, there are availability and affordability barriers for high-risk homeowners. In the earthquake market, a mega-earthquake could put the insurance sector under extreme financial stress, posing a severe risk to the stability of Canada's economy and the well-being of Canadians.

Along with the direct threat of a mega-quake to the capacity for insurers to operate effectively, a mega-quake poses a wider, systemic threat to the industry. Insurers in Canada have a system in place whereby they collectively pay the policyholder claims of any insolvent insurer.[3] Normally, this is an important and valued policyholder protection mechanism. It was, however, designed to handle one-off insolvencies, rather than the many simultaneous failures that could occur following a mega-earthquake. Since a significant earthquake is one of the few risks in Canada (other than an asteroid strike or solar storm) that could overwhelm the reserves of insurers and cause multiple companies to fall below their statutory capital requirements, this collective policyholder compensation mechanism could create a liability large enough to bankrupt the entire Canadian insurance industry and leave all Canadian policyholders from all lines of business – including home, business and auto – without insurance protection.[4] This, in turn, would have devastating ripple effects throughout the whole national economy, with the potential for widespread defaults in the mortgage market, as well as disruptions to vital supply chains and trade networks.

Gaps in Canada's private flood and earthquake insurance markets have saddled federal and provincial governments with rising costs and financial risks. Many government disaster relief programs, such as

[1] (Insurance Bureau of Canada, 2014)

[2] http://earthquakescanada.nrcan.gc.ca/hazard-alea/simphaz-eng.php

[3] This system is administered by the Property and Casualty Insurance Compensation Corporation (PACICC).

[4] (Property and Casualty Insurance Compensation Corporation, 2013)

Sidebar: The economics of disaster insurance

There are significant gaps affecting Canada's flood and earthquake insurance markets. Bridging these gaps requires a degree of government intervention, including some form of public-private risk-sharing, in order to ensure that Canadians have access to the financial protection they need.

In the case of floods, the residential insurance market is largely missing. Because floods tend to recur in the same places at periodic intervals, those who would purchase flood insurance tend to be those at highest risk of flood damage. This is known as **adverse selection**. Also, unlike idiosyncratic and randomly distributed risks – such as automobile accidents and workplace injuries – floods affect a large number of insured exposures simultaneously, which means an insurer's losses can be catastrophic (what is called **correlation risk**). To avoid operating at a loss, insurers will either charge high (often considered unaffordable) premiums for flood insurance[5] or simply forgo offering it.

In the past, Canadian insurers opted for the latter. More recently, aided by the development of up-to-date flood mapping, a few insurers have begun offering flood coverage to some segments of the country. However, much uncertainty remains around this market's scope. In particular, coverage for high-risk properties that need it the most is likely to remain either unavailable or unaffordable, unless governments and insurers can ensure the right preconditions are in place.[6]

In the case of earthquakes, there is a strong residential insurance market in Canada, but it functions at a level that is generally suboptimal for both insurers and consumers. As in the case of flood, correlation risk means that earthquakes generate catastrophic losses. Unlike floods, however, earthquakes also pose a **solvency or capital risk**. That is because, while Canadian insurers are financially prepared for an extremely large event, the presence of **tail risk**[7] and **uncertainty** in the distribution of earthquake outcomes means that losses from a powerful earthquake could stretch beyond what the market can prepare for.

The 2011 earthquake and tsunami in Japan drove home the point that earthquakes can exceed even our worst expectations. This event – the most costly natural disaster in history – occurred in a zone that seismologists believed was incapable of generating an earthquake of such magnitude.

The presence of tail risk and uncertainty also means that the cost of capital incurred by insurers to secure sufficient financial resources is much higher than for most other lines of business, putting pressure on coverage, premiums and deductibles paid by consumers. Prompted by property value increases, higher regulatory capital requirements and an improved assessment of the risk, the trajectory in the Canadian earthquake insurance market has been, over the last decade or so, toward higher costs and more limited coverage.

Homeowners in British Columbia now face deductibles as high as 15% of the value of their home. This creates barriers to take-up of the insurance product, reducing consumer protection. Despite all this, the earthquake insurance take-up rates in British Columbia remain relatively high, at around 55% of households in Vancouver and 70% in Victoria. This compares favourably to other jurisdictions where earthquake insurance is also purchased voluntarily. In California, for instance, only 10% of households buy earthquake insurance,[8] despite similar seismic risk.

[5] Take, for instance, a property worth $500,000 in an area where floods, on average, occur once every 50 years. Assume that a flood is expected to cause damage worth 25% of the property value ($125,000). To break even, the insurer must charge an annual premium of $2,500 (since each year there is a 1/50 probability of a $125,000 loss).

[6] (Insurance Bureau of Canada, 2015)

[7] There is tail risk because the distribution contains outliers (i.e., extreme events) and uncertainty because historical earthquake data is relatively limited, so the precise shape of the distribution is unknown.

[8] http://www.iii.org/issue-update/earthquakes-risk-and-insurance-issues

the federal Disaster Financial Assistance Arrangements (DFAA), exclude payments for losses that could ordinarily have been covered by insurance. The intent is to encourage private insurance take-up, thereby reducing public disaster spending by transferring risk to the private sector, which is better positioned to manage it.

Gaps in the private insurance market, however, tend to leave governments picking up the tab. Indeed, between 1970 and 2013, $6.2 billion or 74% of all federal disaster relief spending in Canada was due to floods. Moreover, realistic estimates of the impact of a major earthquake off the coast of British Columbia suggest that as much as 73% of total property and casualty losses – equal to $54 billion or more – would be uninsured, placing significant pressure on governments to make up for the shortfall and generating severe macroeconomic and fiscal consequences.[9]

Countries around the world have wrestled with these same issues. Based on political, social and other variables, countries must choose whether disaster insurance should be privately provided, publicly provided or somewhere in between. In Canada, the presence of a well-functioning and well-capitalized insurance market means that disaster insurance can largely be privately provided. Nevertheless, the challenges just discussed mean that the government is, in fact, insuring Canadians for large disasters – albeit without collecting any premiums for this risk and without incentivizing risk mitigation behaviour.

2 – How Public-Private Risk-Sharing Can Address Gaps in Disaster Insurance Markets

Gaps in Canada's flood and earthquake insurance markets are due to features intrinsic to these risks: they attract high-risk consumers (adverse selection), they leave insurers facing large numbers of simultaneous claims (correlation risk), and the possibility of extreme events (tail risk) and unknowns around their frequency (uncertainty) mean that insurers face high capital costs and a degree of solvency risk. These challenges, in turn, have left Canadian governments and taxpayers bearing a growing share of the financial cost of disasters.

How, then, can public-private risk-sharing improve these market dynamics? There are at least two basic ways governments can contribute: first, "at the back end" by protecting against peak (or tail) risks, and second, "at the front end" by encouraging the purchase of disaster insurance.

Protecting against peak risks

Where there is a degree of extreme or tail risk in the distribution of disaster outcomes and the frequency of extreme events is unknown, governments can play a market-enhancing role by providing a financial framework to manage peak risks. This may involve – as is the case in many developed economies – providing a stop-loss guarantee to backstop insured losses beyond a pre-established threshold.

[9] (AIR Worldwide, 2013); (Insurance Bureau of Canada, 2014). Includes property and casualty losses only.

Minimizing disaster costs requires allocating risk to those parties best able to bear it.[10] In the case of extreme or peak risks, this requires government intervention.[11] Private insurers and reinsurers have substantial, yet limited, risk-bearing capacity, based on capital availability, risk appetite and other market constraints.[12] Governments, on the other hand, have much greater risk-bearing capacity through a combination of debt financing and revenue generation. Moreover, governments can spread disaster costs spatially, over the entire population, and inter-temporally, across future generations. This makes governments the ideal bearers of low frequency, but high severity – or peak – risks.[13]

In the absence of government support, insurers have only two options – either they exclude or limit coverage for these peak risks, or they look to the reinsurance market to provide the financial backing. But reinsurance for peak losses is also the most expensive, and there are limits to the amount of risk that reinsurers are able to take on. Moreover, reinsurance availability tends to be cyclical, so, while today capital is abundant, future availability cannot be assured. Costs related to reinsurance and the retention of peak risks work their way into the price of disaster insurance, which is ultimately passed on to consumers. This, in turn, reduces demand for the product, leaving consumers unprotected and causing governments to bear the lion's share of the risk. By sharing a portion of peak risks, governments ease these cost pressures and promote greater availability, affordability and stability of coverage. From an economic policy perspective, the benefits of public-private risk-sharing far outweigh the costs required to address these market imperfections.

It should be noted that Canada's federal government employs this approach in other industries. For example, the government backstops the Canada Deposit Insurance Corporation with a $20 billion borrowing program. Similarly, mortgage insurance is subject to a 100% and 90% government guarantee for public and private mortgage insurers, respectively.[14] Federal backstops are also already in place in Canada for man-made disasters, including nuclear power and railway accidents.

Encouraging disaster insurance take-up

There are cases in which the cost of providing insurance is naturally high, to a point that few individuals opt to buy coverage, leaving governments and taxpayers exposed to growing uninsured liabilities. In these cases, governments can address affordability issues through targeted subsidies or incentives for the purchase of disaster insurance – as long as the cost of these demand incentives is lower than the expected losses to taxpayers. This can be achieved through the tax system (e.g., via tax credits) or through subsidies to consumers for particular insurance lines (e.g., via a contribution to a high-risk pool). Since the majority of insurance premiums end up going back out to policyholders in

[10] (Arrow, 1978)

[11] (Litan, 2006). Note that this argument mainly applies to large states with significant assets and diversification potential. It may not apply to smaller states with less risk-bearing capacity.

[12] Constraints to capacity and risk appetite are particularly acute in Canada, where a majority of the largest insurers are domestic, and have no recourse to capital from – or the ability to spread risk globally through – an international parent.

[13] In economic terms, governments generally face a lower marginal cost per unit of risk vis-a-vis an insurer or reinsurer.

[14] Note that in the event of a major earthquake and in the absence of adequate insurance, the federal government may ultimately incur liabilities via this guarantee.

the form of claims payouts,[15] government subsidization of insurance is essentially just a more explicit and disciplined way of preplanning for disaster costs and protecting consumers.

One reason why governments often favour this approach is because disaster insurance is a type of **merit good**. A merit good is something that generates social and public benefits that go beyond its direct benefits to the consumer (what economists call "**positive externalities**"). Because of these ancillary benefits, from society's perspective, merit goods are under-consumed, leading governments to encourage demand for them.

Disaster insurance is a type of merit good because when individuals buy it, society as a whole stands to benefit. The premiums paid by those who buy disaster insurance reduce the share of disaster costs borne by governments and taxpayers at large. Like other merit goods, disaster insurance also tends to be under-consumed, since those who choose not to insure themselves get a "free ride" off taxpayer-funded relief. This tendency is exacerbated due to inadequate risk awareness, and our tendency to discount and under-prepare for future, far-off risks (what behavioural scientists call "myopia" – literally, "nearsightedness").

How public-private risk-sharing reduces disaster costs

Governments incur costs when they take on peak risks and subsidize disaster insurance, just as they do when they provide post-event disaster relief. Why should governments prefer pre-funding and preplanning over after-the-fact financial relief? The simple answer is that indemnifying disaster losses via private insurance is more cost-efficient. Public-private risk-sharing partnerships can actually reduce government disaster costs over the long run.[16]

By hedging disaster risk via private insurance, governments transfer disaster costs to the private sector. This means that after a disaster, governments have less need to employ costly, counter-cyclical measures to finance recovery, which lead to unexpected budget deficits and growing national debt. This also brings about lower budget volatility and increased planning certainty in the public sector.[17] Preplanning for losses, by making disaster costs more explicit, also strengthens incentives for governments to take risk-reduction measures to reduce their exposure over time.

One might argue that by absorbing peak risks, governments take on an open-ended liability. However, the net fiscal effect of bearing this risk is, in most cases, actually positive. By providing financial backing for outlier events (i.e., rare, extreme catastrophes), and thus enabling private insurers to absorb more risk over time, governments can increase the overall amount of risk transferred to private insurers.[18] This occurs because lower loss variance enables a more robust market to develop for smaller, more frequent losses, and thus insurers end up absorbing a greater proportion of losses on average (see **Illustration** below.) This also creates greater certainty around roles and responsibilities for post-disaster loss compensation, encouraging insurance take-up among those who may have not

[15] In Canada, about 55 cents out of every premium dollar insurers receive is paid out in claims. See, for instance, IBC's *2015 Facts Book*: http://assets.ibc.ca/Documents/Facts%20Book/Facts_Book/2015/FactBook-2015.pdf.

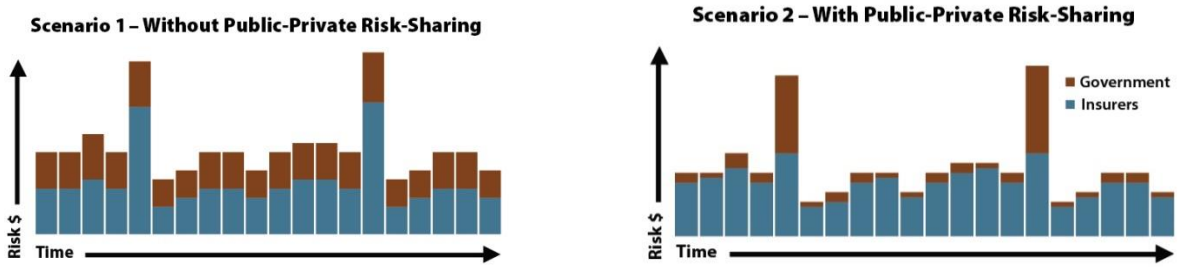
[16] (Insurance Bureau of Canada, 2014)

[17] (Swiss Re, 2011a)

[18] (Murdock & Lewis, 1996); (Zeckhauser, 1999); (Paudel, 2012)

sought coverage due to expectations of government relief (i.e., minimizing **moral hazard**[19]). In other words, it helps ensure that those who are at risk of disaster actually contribute financially toward its cost, and so have more reason to take necessary precautions.

Illustration of hypothetical risk transfer with and without public-private risk-sharing



As illustrated by the hypothetical scenarios above, public-private risk-sharing can shift the distribution of risk from governments to insurers as well as reduce the overall amount of risk, due to private insurers' roles in incenting risk reduction measures and accelerating economic recovery.

Furthermore, where disaster losses are hedged through the private insurance market, the overall cost of disasters has a tendency to decrease.[20] This is due to certain structural features of privately provided insurance, features that public disaster relief schemes often lack.

The most important of these is risk-based pricing. Since insurance premiums are based on the vulnerability of the insured exposure, policyholders have a price incentive to invest in risk-reduction measures. These can range from basic initiatives – such as installing backwater valves and wind-resistant shutters – to more intensive measures, such as relocating off a floodplain. Other insurance features such as deductibles and co-insurance further encourage risk reduction by making individuals retain part of the risk.

Another way private insurance helps to reduce a disaster's overall financial impact is by stimulating economic recovery.[21] There are at least three channels through which this occurs. First, unlike public relief, which is typically limited, insurance typically provides more comprehensive loss compensation, so individuals and businesses get back on their feet – and back to work – more quickly. Second, insurance tends to put reconstruction funds to best use (i.e., it allocates funds efficiently), since they go out to facilities that individuals considered valuable enough to warrant insurance coverage (often those with a productive purpose).[22] Third, because of insurers' expertise in claims handling, insurance compensation tends to reach affected areas fairly rapidly.

[19] Moral hazard occurs when risk mitigation actions are not taken because the cost of the risk has been transferred to a third party. Moral hazard is a feature of public disaster relief programs, since those who believe that the cost of disaster recovery will be borne by the government (the "third party") lack a strong incentive to undertake measures to protect themselves against the risk (e.g., by buying insurance).

[20] (Von Peter, Von Dahlen, & Saxe, 2012)

[21] (Insurance Bureau of Canada, 2014)

[22] (Von Peter, Von Dahlen, & Saxe, 2012)

For example, after the 2013 Alberta floods, an IBC survey of insurers showed that almost half of filed claims had been settled within three months of the disaster.[23] More generally, over four-fifths of insurance claims are paid out within two years of an event.[24] Together, these channels – fuller loss compensation, efficient fund allocation and timely payouts – help a disaster-stricken economy bounce back quicker. Faster economic recovery, in turn, lowers a disaster's fiscal cost by addressing consumer confidence, growing the tax base and reducing public expenditure needs for relief and reconstruction.

3 – How Public-Private Risk-Sharing Works Around the World

In this section, we explore how public-private risk-sharing works in various countries to collect lessons learned that can be applied to Canada's earthquake and flood markets.

Earthquake

California Earthquake Authority

The California Earthquake Authority (CEA) provides residential earthquake insurance in the state of California. It is privately funded, largely through consumer premiums, but also via capital contributions from participating insurers.

The CEA was established in 1996 in response to a capacity crisis in the homeowners' insurance market, triggered by the 1994 Northridge earthquake. The Northridge quake cost more in claims than the industry had collected in earthquake premiums over the preceding 30 years. The CEA was set up to relieve the capacity shortage.

The CEA's claims-paying capacity is comprised of its capital, private reinsurance program, and the right to borrow funds and assess its member insurers. Capacity currently sits at over $11 billion. If an earthquake generates losses above this, policyholders may be paid a pro-rated portion of their insured losses or paid in instalments.

Although the CEA is run largely like a private insurer, it is overseen by a public governing board consisting of California's governor, state treasurer and insurance commissioner, to whom CEA's executive management report directly.

Participating insurance companies process all CEA policy applications, policy renewals, invoices and payments, and handle all CEA claims. The CEA reimburses companies for the administrative costs related to these services and provides insurers with funds to settle claims.

Take-up of earthquake insurance in California is only about 10%. This low take-up rate has been attributed to the relatively high cost of the product, the fact that lenders do not require earthquake insurance and regulations that allow homeowners to walk away from underwater mortgages.

[23] The insurers surveyed represented about three-quarters of the Alberta property market.

[24] Reinsurance Association of America

Key Findings

- The CEA model is effective in relieving capacity constraints on the property and casualty insurance industry and limiting insolvency risk.
- Disaster insurance schemes, such as the CEA, that do not have recourse to public funds are subject to inherent capacity constraints based on what the market can bear. Enabling claims-payout pro-rating is an effective way to address events that exceed the market's capacity and a preferred alternative to allowing insurers to fail, as claims payouts help stimulate economic recovery.
- The lack of diversification and a heavy reliance on private reinsurance raise consumer costs, which in turn discourages take-up.

Japan Earthquake Reinsurance Company

In Japan, primary insurers reinsure the residential earthquake policies they underwrite with the Japan Earthquake Reinsurance Company (JER), a quasi-public company owned by Japan's property and casualty industry. The JER retains a share of the risk. Insurers and government share the rest.

More precisely, the first ¥100 billion ($1 billion CAD) in claim liabilities is retained by the JER; the next ¥262 billion ($2.6 billion CAD) is split equally between government and insurers; and the final ¥6,638 billion ($66 billion CAD) is 99.5% assumed by the government (see **Figure A**).[25] As of 2014, the total liability limit of the arrangement is ¥7.0 trillion ($70 billion CAD), beyond which claims are prorated, which means that all insureds have their claim payouts reduced by a common ratio.

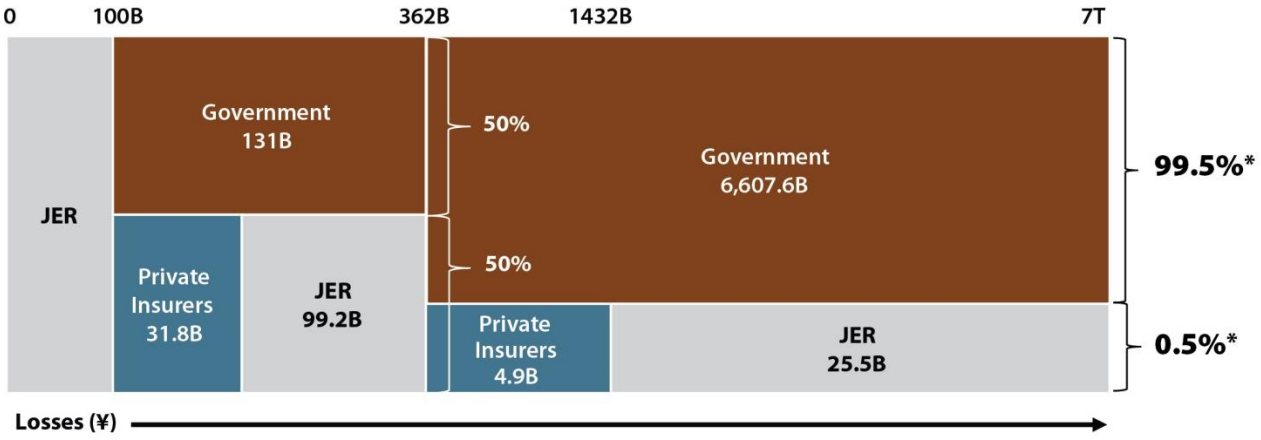
One advantage of this cost-sharing approach is that it provides incentives for governments, insurers and policyholders to undertake risk-reduction measures to obtain lower (re)insurance premiums. It also greatly improves insurance capacity and limits insolvency risk, allowing for greater absorption of smaller more frequent losses and lower, more affordable, premiums.[26] Beyond this system, the Japanese government also encourages earthquake insurance take-up at the "front end" through tax relief on earthquake premiums.[27] Take-up of the JER's earthquake insurance is about 50% in the most exposed regions. Japan's earthquake insurance system was a key factor in the country's economic recovery after the 2011 earthquake and tsunami. Following the disaster, insurers settled 90% of claims within the first three months, making insurance one of the first forms of relief to reach the disaster area.

[25] Note that these shares reflect the 2011 earthquake and tsunami – under less financially constrained circumstances, Japan's property and casualty industry retains somewhat more of the risk, though the government retains its majority stake.

[26] (Swiss Re, 2011b)

[27] https://www.kpmg.com/Jp/ja/knowledge/article/research-report/Documents/taxation-in-japan-201410.pdf (p. 95)

Figure A. Japan's government-insurer cost-sharing system for earthquake risk



*Approximate values

Key Findings

- Japan's risk-sharing system improves financial capacity for insurers and limits insolvency risk. This, in turn, enables the absorption of smaller, more frequent losses as well as lower, more affordable insurance premiums.
- The scheme is exemplary in creating incentives for risk reduction for all participants.
- A proactive approach aids economic stability and recovery post-disaster.

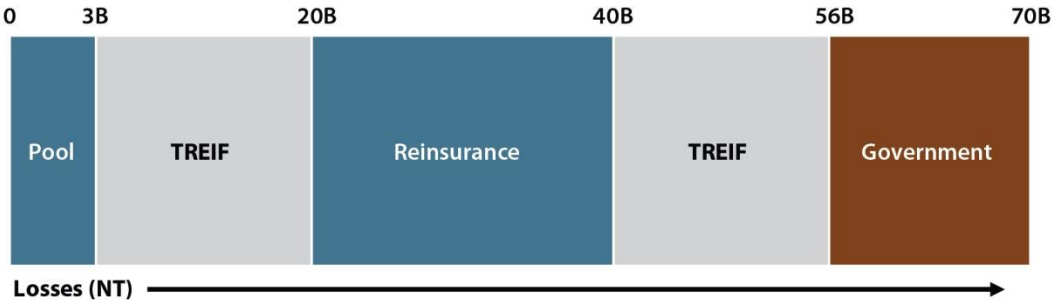
Taiwan Residential Earthquake Insurance Fund

In Taiwan, all residential fire insurance policies automatically include basic coverage for earthquake risk. An annual flat premium of NT$1,350 ($54 CAD) applies. Premiums are collected by primary insurers, who retain a small percentage and transfer the remainder to the Taiwan Residential Earthquake Insurance Fund (TREIF).

In the event of an earthquake, responsibility for insurance claims liabilities is assumed in layers (see **Figure B**). The first layer is a co-insurance pool composed of primary insurers, which retains the first NT$3 billion ($120 million CAD) of earthquake risk. The next NT$53 billion ($2.1 billion CAD) of risk is spread between TREIF reserves and its (private) reinsurance. The Taiwanese government reinsures earthquake liabilities once claims exceed NT$56 billion (i.e., once TREIF and industry funds are exhausted). The aggregate limit per earthquake event is NT$70 billion ($2.8 billion CAD). If this limit is exceeded, claims are prorated.

Take-up rates are 31% nationwide and have been steadily increasing since the program was introduced in 2002.

Figure B. Public-private risk-sharing for earthquake risk in Taiwan



Key Findings

- Taiwan's scheme improves financial capacity for insurers and limits insurer insolvency risk.
- The scheme allows insurers to economize on reinsurance costs and permits lower, more affordable premiums.

Flood

National Flood Insurance Program (U.S.)

In the U.S., overland flood insurance is available through a federal program – the National Flood Insurance Program (NFIP). Homeowners can purchase NFIP coverage only if they live in eligible communities; to be eligible, communities must commit to specific floodplain management requirements around development and zoning.

Properties are provided insurance at subsidized premium rates, at a discount as high as 40% of the risk-based rate. In exchange for an expense allowance, private insurers write and service NFIP policies under their own brand.

As NFIP insures high-risk homeowners at actuarially unsound rates, the program has borne structural weaknesses since its inception, but it was only after Hurricane Katrina that the program's financial mismanagement became fully apparent. In the aftermath of Katrina, NFIP paid out more claims than it had paid out over the entire life of the program up to that point.[28] Hurricane Sandy, in 2012, compounded these losses.

The major reason for the program's financial difficulties was its reliance on outdated risk maps. This meant that not only was the risk generally underpriced at the retail level, but also that the total risk accumulation, and hence the need for tail risk reinsurance, was underestimated. Other reasons included a lack of effective mitigation, buyout and re-location programs, which kept repeat-loss properties under the program's umbrella, as well as inadequate enforcement of stringent land use regulations and development controls.

[28] (Kousky & Kunreuther, 2013)

NFIP largely continues to operate thanks to a lending guarantee by the federal government. Its debts stand at approximately USD$24 billion.

In recent years, NFIP's financial problems have become highly politicized, and efforts to move rates closer to their risk-based level have been scaled back due to concerns over affordability.

For more information, see IBC's review of flood management programs in G8 countries, *The Financial Management of Flood Risk*.[29]

Key Findings

- NFIP has significant merits: it gives high-risk homeowners access to affordable insurance, it leverages the existing insurance distribution network, and it provides some incentives for communities to invest in risk reduction measures.
- However, the program also has some important drawbacks: a reliance on outdated risk maps meant risk was priced too low and incentives for risk reduction/relocation have proved insufficient. As a result, the program has resulted in unsustainable financial costs to the U.S. government.

[29] http://assets.ibc.ca/Documents/Natural%20Disasters/The_Financial_Management_of_Flood_Risk.pdf

Flood Re (U.K.)

In the U.K., flood insurance is privately offered. Flood Re – an agreement between insurers and the government – is scheduled to come into effect in April 2016.

Under this new program, insurers are required to offer coverage to high-risk properties. For the highest-risk homes, insurers can choose to cede the policy to Flood Re. Premiums for high-risk properties are artificially capped, with the caps based on assessed property values. The difference between the capped premium and the actuarially fair rate is subsidized by consumers through a levy of £10.50 ($20 CAD) on all household premiums country-wide. Properties built after 2009 are exempt from the program, in order to discourage development on flood plains.

The program was enabled thanks to several government measures, including a commitment to flood defence spending and a backstop guarantee for annual losses to the pool in excess of the 1-in-200-year level.

For more information, see IBC's review of flood management programs in G8 countries, *The Financial Management of Flood Risk.*

Key Findings

- Flood Re demonstrates that both insurers and governments need to have a stake in mitigation outcomes: insurers, by extending coverage to high-risk properties; and governments, by committing to mitigation initiatives and backstopping extreme losses.
- A key feature of the scheme is its exclusion of new developments on flood plains. It is expected that this will help to mitigate the program's cost over the longer term.
- The program has faced some criticism due to the fact that it does not exclude expensive riverside homes. Issues of socioeconomic fairness are indeed relevant to program design, and should be paid due consideration.

Other perils

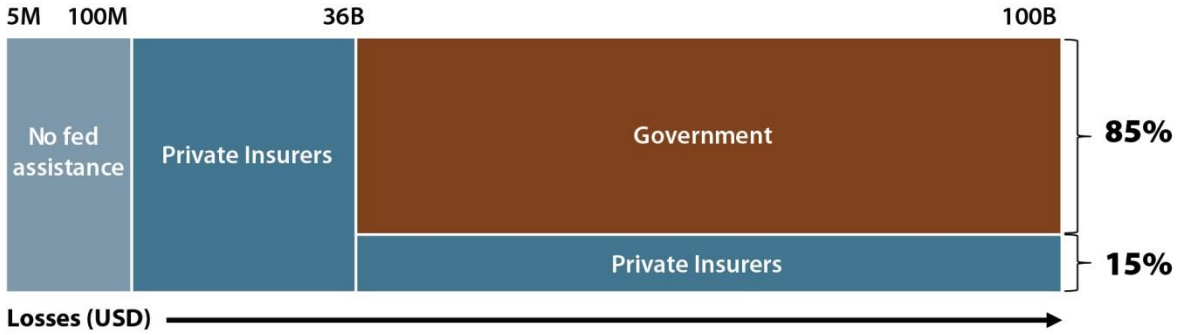
Other jurisdictions use public-private risk-sharing mechanisms for peak risks that are conceptually similar to floods and earthquakes, such as terrorism and hurricanes.

Terrorism Risk Insurance Act (U.S. – Terrorism)

Following the September 11, 2001, terrorist attacks, commercial insurance coverage for terrorism losses in the U.S. became very expensive, and many insurers withdrew the coverage entirely. In response, the U.S. Congress passed the Terrorism Risk Insurance Act of 2002 (TRIA). With TRIA, the U.S. government shares some of the insured losses of a terrorist attack with private insurers. Private insurers, in return, have an obligation to make terrorism coverage available. Originally created with a three-year term, the program was extended in 2005, 2007 and again in 2014.

For TRIA coverage to take effect: (1) an act of terrorism must cause at least USD$5 million in insured losses; (2) the aggregate annual insured loss from acts of terrorism must be at least USD$100 million; and (3) each individual insurer must meet a deductible of 20% of its annual premiums. Once these thresholds are passed, the government covers 85% of the insured loss. When losses exceed USD$100 billion, claim payouts are prorated (see **Figure C**). The government can recoup its payouts with a 3% surcharge on future premiums.[30]

Figure C. Public-private risk-sharing for terrorism risk in the United States



Since TRIA's establishment, the commercial terrorism insurance market in the U.S. has largely recovered. Over time, premium prices have dropped and financial capacity has increased. Take-up rates now stand at around 62%.[31]

Key Findings

- TRIA has enabled a commercial terrorism insurance market to exist in the U.S. Without some kind of risk sharing in place, the market would evaporate.
- Assessing terrorism risk accurately is challenging. As a result, it is also difficult to assess the appropriateness of program parameters (e.g., trigger thresholds). This is inevitable for schemes that deal with risks that are difficult to model.

[30] Note that these figures reflect program parameters in 2015. The program trigger and federal loss share are scheduled to undergo stepped increases through to 2020.

[31] (Congressional Research Service, 2014)

Florida Hurricane Catastrophe Fund (U.S.)

The Florida Hurricane Catastrophe Fund (FHCF), a tax-exempt trust fund, was created by the Florida Legislature in 1993 after Hurricane Andrew (1992). Similar to a reinsurer, FHCF reimburses insurers for a share of their insured losses due to hurricanes. FHCF coverage is, however, cheaper than traditional reinsurance due to the fund's tax-exempt and non-profit status, low administrative costs and lack of risk-load.

The FHCF collects premiums from, and provides reimbursements to, insurers writing residential property and casualty insurance policies within the state. Every insurer writing residential property policies that provide wind coverage is required to contract with the FHCF.

Insurers have the option of selecting a coverage of 90%, 75% or 45% of insured losses (the vast majority choose 90%). FHCF reimbursement is triggered after an insurer meets its retention (effectively a deductible). An insurer's reinsurance premium, retention and coverage limit are based on its total insured values by zip code.

FHCF pays claims through its accumulated reimbursement premiums, investment income and proceeds from pre- and post-event financing (such as post-event bond issues and emergency assessments). The maximum obligation of the FHCF for a given contract year is USD$17 billion. Since its inception, FHCF has been seen as successful in stabilizing the Florida insurance marketplace and cushioning the impact of hurricane losses in the state. Some have cautioned, however, that the FHCF may not have sufficient capacity to pay claims in a timely manner in the event of a $50+ billion (1-in-100-year or more) hurricane.[32] Ultimately, there is a trade-off between increasing the fund's size and ensuring its financial structure (i.e., its capacity to raise funds in the bond market and to assess policyholders) does not jeopardize market stability.

Key Findings

- FHCF has improved the availability, affordability and stability of residential property insurance in the state, which has, in turn, helped Florida's economy recover in the wake of severe hurricanes.
- As a result of limited capacity, the program has suffered losses beyond its financing capacity in some years, resulting in higher premiums (via the emergency assessment) for most policyholders in the state.
- The program's dependence on its ability to borrow in the bond market has been flagged by some as a potential weakness, particularly during periods of financial market uncertainty.
- Any scheme that relies on broader policyholder assessments to account for financial shortfalls should carefully consider trade-offs between financial capacity and market stability.

[32] (The Florida Catastrophic Storm Risk Management Center, 2013)

4 – Applying International Lessons Learned to Canada

The most basic lesson from this scan of public-private risk-sharing arrangements is that, when carefully designed and executed, they generally function as intended – i.e., they tend to expand private insurance capacity; promote greater availability, affordability and stability in coverage; and help create greater certainty around how disaster costs are allocated between governments and insurers. It is also clear, however, that poor design and a lack of careful planning can lead to perverse outcomes, inadequate coverage for consumers and unsustainable costs to governments.

Another feature of many of these schemes is that they tend to be implemented only after a catastrophic event, not before. In some cases, this is understandable, given the unprecedented nature of the risk. But where the relevant perils are largely foreseeable, and the risk is understood and quantified, there are clear benefits to taking a proactive approach. In the absence of pre-established institutional arrangements, governments are left to react in an undisciplined, ad hoc manner – leaving consumers, businesses and the economy unnecessarily exposed.

Taking a closer look at these schemes there are, in terms of best practices, at least three design considerations to highlight.

First, where a government subsidizes disaster insurance premiums (directly or indirectly), care must be taken to ensure that subsidies do not undercut incentives for risk reduction. While a degree of subsidization is often necessary to ensure affordability and sufficient take-up, prices must be risk-based. This requires the use of up-to-date risk maps and other risk assessment tools. Here, NFIP provides a cautionary example. Addressing affordability issues should not come at the expense of promoting risk reduction through risk-based pricing. Some have suggested, for instance, using means-tested vouchers to subsidize disaster insurance, as a substitute for direct interventions in premium pricing (premium caps).[33] At a minimum, however, subsidies or incentives should complement – not eliminate – risk-based pricing.

Second, public-private risk-sharing arrangements should aim to supplement, not crowd out, private insurance capacity. Where a well-functioning private insurance market exists, as is the case in Canada, the government should act only as an enabler of insurance and an insurer of last resort. As much of the risk as possible should be left to the private market, which is best positioned to manage it. Since the optimal level of risk-sharing between the government and the industry will naturally fluctuate with market dynamics, systems should come equipped with review mechanisms to ensure capacity is being deployed efficiently over time.

Third, risk-sharing arrangements should be structured to promote (or, at least, not discourage) risk reduction among all participants. As just discussed, insurance premiums should be risk-based. All parties should retain a share of the risk. And where the government acts as a reinsurer or guarantor, the attachment point or "trigger" should be set on an industry-wide basis in order to minimize insurer

[33] (Kousky & Kunreuther, 2013)

moral hazard.[34] Together, these measures help promote prudent risk management among all stakeholders.

What, then, are the implications for Canada's flood and earthquake insurance markets?

In the earthquake market, we have seen that the financial repercussions inherent in the extreme nature of the risk threaten the stability of the national economy.

In this environment, some form of risk-sharing arrangement between governments and the industry for peak losses would materially improve market conditions and help stabilize the market after an event, ultimately ensuring consumer protection. Both the case of JER in Japan and TRIA in the U.S. offer a viable model for a Canadian solution to earthquake risk.

In the flood market, there are structural availability and affordability barriers for high-risk homeowners. The introduction of a risk-sharing partnership between government and insurers would help allocate disaster risk, expanding the private sector role while promoting risk reduction and fiscal probity. Both Flood Re in the U.K. and the NFIP in the U.S. illustrate partial solutions – though neither is a perfect model for our specific circumstances.

In the absence of public-private risk-sharing arrangements, Canadians face limited access to disaster insurance – especially those living in high-risk areas who need it the most. Governments will continue to play their *de facto* role as insurers for large disasters, leading to greater budget volatility, less planning certainty and, ultimately, higher costs for taxpayers. Moving toward a public-private risk-sharing approach can avert these outcomes and contribute to a more disciplined and cost-efficient disaster risk management regime.

[34] (G20 & OECD, 2012); (Murdock & Lewis, 1996)

Glossary

Adverse selection
Adverse selection occurs when high-risk consumers are largely the only ones attracted to a particular line of insurance. This negates the cost benefits of diversification through risk pooling. In insurance pools subject to adverse selection, actuarially fair premiums are typically very expensive.

Correlation risk
Correlation risk occurs when the risk of an accident befalling one insured exposure is correlated with the risk of it befalling one or more other exposures. When an insurer's portfolio is subject to correlation risk, it cannot achieve cost benefits typically derived through diversification.

Merit good
A merit good is one whose social benefits of consumption are greater than its private benefits. Examples include public education, housing, health services and disaster insurance.

Moral hazard
Moral hazard occurs when risk mitigation actions are not taken because the cost of the risk has been transferred to a third party.

Positive externality
A positive externality arises when a third party, who was not part of some transaction, benefits from it.

Public-private risk-sharing
This is an institutional arrangement in which the public and private sectors share catastrophic risk in order to improve conditions in the private market. Typical forms of catastrophic risks covered include earthquakes, floods, hurricanes, terrorism and nuclear disasters.

Solvency/capital risk
The risk that an insurer may not have sufficient assets and capital to meet its claims liabilities.

Tail risk
Tail risk refers to the presence of outliers (extreme events) in the statistical distribution of disaster outcomes.

Uncertainty
This occurs when a lack of information and historical data on disasters means the likelihood of future disasters is indefinite or incalculable.

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