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EARTHQUAKE'S INSURABILITY

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Article abstract

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The author retraces the origin of protection against earthquake. He explains that the trouble with earthquake insurability is determining a scientific model, making that catastrophe event difficult to be rated and to be transferred to the reinsurance market. He is questionning what the insurance industry does after such an event and also the role il can play in loss mitigation.

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ABSTRACT

In the following pages, Mr. Robey introduces his subject by saying that we know the earthquake event will occur and will cause important damage, but we do not know when it will happen. Because we know its realisation, we can keep the damage to a minimum. Since we know for sure that the earthquake will happen, cushioning the economic impact and speeding recovery afterwards are just as important, and this is where the insurance industry comes in.

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RÉSUMÉ

Dans les pages qui suivent, M. Robey commence par mentionner que le risque de tremblement de terre est bien connu et qu'il va se manifester de façon certaine et provoquer des dommages importants. La seule inconnue est que nous ignorons la date exacte de cette manifestation. Sachant en toute certitude qu'ils vont se produire, nous pouvons donc maintenir les dommages au minimum, en modelisant leur impact économique et les mesures subséquentes de recouvrement en toute célérité. Tel est l'objet de l'assurance.

L'auteur retrace les origines de l'assurance des tremblements de terre. Il explique que le problème de l'assurabilité de ce risque est de déterminer un modèle scientifique à la mesure d'un tel événement scientifique difficile à évaluer et à transférer au marché de la réassurance. Finalement, il s'interroge sur ce que peut faire l'industrie de l'assurance suite à la réalisation du risque de tremblement de terre et du rôle qu'elle peut jouer en minimisant les pertes.

The author:

Christopher J. Robey is President of Aon Re Canada. Speech presented at the Earthquake Symposium, Institute for Catastrophic Loss Reduction, Vancouver, March, 1999.

Earthquakes are not like other events we insure, and not just because of the amount of damage they cause. We know we will have fires and burglaries and negligence claims, and we know that, throughout the country, we shall have many thousands of them every year. What we do not know is exactly where they will happen. A fire will strike one building, but leave the building next door untouched. A month later, the building next door may burn. For the most part, it is haphazard.

On the other hand, we know that an earthquake will hit Vancouver and we know that there will be at least some damage to the building on this site or its contents. We also know that, once we have had that earthquake, and its aftershocks, we will not get another one for many years afterwards. What we do not know is when that earthquake will happen. It may be this afternoon, it may not be in our lifetime. But we do know it will happen and we cannot stop it. All that we can do is keep the damage the earthquake does to a minimum. It is too late to move everyone out of Vancouver, Montreal and Quebec City, so the work of the Institute for Catastrophic Loss Reduction, our sponsors today, is important. Keeping the damage to a minimum through efforts before the earthquake is an important part of the equation. However, since we know for sure that the earthquake will happen, cushioning the economic impact and speeding recovery afterwards are just as important, and this is where the insurance industry comes in.

Insurers have been providing protection against earthquake for many years now. Lloyd's cemented its reputation as a non-marine insurer following the San Francisco earthquake of 1906. It was after that event that Cuthbert Heath, a leading Lloyd's underwriter at the time and a pioneer in such insurance, brushed aside a debate over coverage by instructing his agent to "pay all our policyholders in full irrespective of the terms of their policies".

The trouble with earthquakes from an insurance point of view, apart from the damage they do, is that they do not lend themselves to deterministic modeling. They do not happen very often and no insurer has ever paid a loss from a major earthquake in Canada, so the insurer has trouble estimating what the loss would be if it did happen. This in turn makes it difficult to know what to charge.

Fortunately, advances in earthquake science and modeling have enabled the insurer to get a much better idea of what its loss from an earthquake might be.

Probably the first model which enabled an insurer to come up with much more than a guess of its earthquake probable maximum

loss was developed by the Munich Re and became available for Canada at the beginning of this decade. Next came the first IRAS model designed by Risk Management Solutions, which was introduced in Canada in 1991 and began to obtain wide acceptance in 1993. There are a variety of other models now available – Applied Insurance Research, EQE, EQ Canada and a number of others, but the IRAS model is the most common.

Although we have made tremendous advances in the last ten years in estimating earthquake probable maximum losses, we have always to remember that we are still dealing with estimates and have not had the event which will test how good those estimates are. The models rely for their accuracy on two things – the quality of the science in their design and the quality of the information fed in by the user.

I am not qualified to comment on the quality of the science, but we must always remind ourselves that it is still developing and the models therefore are still evolving. The latest version of IRAS reduced PML's in Vancouver on average by about 50% compared to the previous version, a huge difference considering the role the model plays in the planning of reinsurance protection by many insurers.

Given the number of models available and the varying results they produce, a multi-model approach has much to be said for it. Looked at in isolation, the cost of modeling may seem high, but compared to the cost of catastrophe reinsurance, it is quite small, and compared to the cost of a catastrophe loss, it is infinitesimal, so using more than one model would seem to be a good investment.

The second important aspect is the quality of data being fed into a model. Our company has done a lot of work on this and has a team on staff which specializes in cleaning up the data before it is used. Our experience has not been encouraging.

First, there is junk coding, which is usually easy to find. An example is the use of A1A 1A1 when the actual postal code is not available. Unusually high exposures in Newfoundland, or any exposure in Newfoundland for a company which does not operate there, is fairly easy to detect.

Second is mis-coding – a simple input error which can have a variety of effects, depending on the error. An error in the address can shift a risk from one postal code to another and be difficult to identify. Another problem arises when a policy covers values at more than one location, but captures only the address of the insured.

Entry errors in the sum insured also occur. Entering a $1 billion instead of $1 million is quite easy to detect, but $1 million instead of $100,000, or the reverse, is less evident and a number of such errors can accumulate into a significant difference in the model's output. Mistakes entering deductibles are also easy to make and difficult to detect, but with a potentially important impact on the final result.

Third is no coding at all, for example a commercial policy with multiple locations where only those of the highest values are coded. The uncoded values may not be important to the underwriting of the policy itself, but enough of them in certain parts of the country can make a significant difference to the quality of the output of the model.

All these things reduce the quality of the output, but let us remind ourselves again that despite all of this, what we have today is far superior to what we had available to us ten years ago. You have only to listen to the complaints about today's models to realize how true this is. We are now complaining about the fine-tuning of the models. Ten years ago, we did not have a model to complain about.

Even with the increased quality of the models, there are some things they do not do, and others they do not yet do well. The science underlying the modeling of shock losses is advanced, but modeling fire following is still an area where judgement plays a major role, and circumstances at the time of the quake have a major impact. How windy will it be and which way will the wind be blowing? Will there be enough water pressure? Will the fire trucks be able to get through the rubble to where they need to be? Modeling can deal with these issues, but what do we want to know? The most likely scenario or the worst possible?

Another issue is the use made of the model output. In Canada we have adopted as more or less standard the 250-year return period. This is the same as used in California, but it is used there because it represents the worst case scenario. The worst case in British Columbia has a 14,000-year return period. I am not suggesting we adopt that as our standard, but it does make one wonder what is special about 250 years. The Federal regulator is gradually moving to 500 years as the Canadian standard, but, although it is safer than 250 years, there is not really any more justification for picking it. The 14,000-year event could happen next week.

With the tremendous improvements over the last decade, insurers now realize that their exposure to earthquake is much

greater than they thought it was. Nonetheless, earthquake insurance is readily available in British Columbia and Quebec at an affordable price and there is no reason to believe that that will not continue.

This has also been a decade of tremendous change in the insurance market offering earthquake cover.

In 1990, the top ten insurers in British Columbia wrote 50% of the property premium.

Rank	Company Name	Direct Premium Written (000's)	% of Total	Cumulative %
1	Canadian Northern Shield	$41,275	7.44%	7.44%
2	Lloyd's Non-Marine	$32,100	5.78%	13.22%
3	Guardian Insurance Co. of Canada	$29,774	5.36%	18.58%
4	Continental Canada Group	$27,210	4.90%	23.48%
5	Wawanesa Mutual Insurance	$27,028	4.87%	28.35%
6	Zurich Canada Group	$26,853	4.84%	33.19%
7	Simcoe Erie Group	$26,806	4.83%	38.02%
8	Wellington Insurance Company	$24,645	4.44%	42.46%
9	Commercial Union Canada	$22,413	4.04%	46.50%
10	Royal Canada Group	$20,818	3.75%	50.25%

By 1997, the top ten wrote nearly 60% of that premium.

Rank	Company Name	Direct Premium Written (000's)	% of Total	Cumulative %
1	General Accident Group (Canada)	$112,795	11.88%	11.88%
2	Canadian Northern Shield	$69,877	7.36%	19.24%
3	ING Canada	$62,853	6.62%	25.86%
4	Lloyd's	$49,428	5.20%	31.06%
5	Wawanesa Mutual Insurance	$48,397	5.10%	36.16%
6	Royal & Sunalliance Canada	$45,654	4.81%	40.97%
7	Axa Canada Inc.	$45,652	4.81%	45.78%
8	Dominion of Canada Gen.	$44,933	4.73%	50.51%
9	British Columbia Insurance	$43,388	4.57%	55.08%
10	Zurich Canada Group	$41,727	4.39%	59.47%

By 2000 it will probably be 70%.

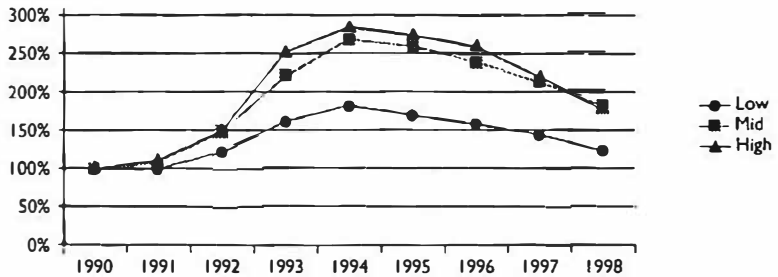
This consolidation is not a bad thing, when looking at the ability to provide earthquake protection. Although it concentrates the exposure in fewer hands, they are stronger hands. The largest writers

are all strong in their own right as well as being part of important foreign groups. And it is at the top end that the increase in market share for this group has come. The tenth largest in 1997 wrote 4.39% of the market, compared to 4.44% for the eighth largest in 1990. The largest in 1997 is almost 12%, compared to about 7.5% for the largest in 1990. In fact, 8 points of the 10-point increase in the market share of the top ten can be found in the top five, a share which went up from 28% to 36%.

This sort of concentration does make us more vulnerable to the decisions of a single insurer, but we should keep things in perspective. The current top estimate for the insured loss in a British Columbia earthquake is around $10 Billion, only 20% of the likely insured loss from a major quake in Los Angeles or Tokyo or the worst case hurricane scenario for Florida. If we can find the capacity to protect against those disasters, we are not likely to have a problem finding the capacity needed in British Columbia or Quebec.

The reinsurance market, of course, provides much of the capacity currently used. In the eastern Canadian ice storm of 1998, the largest loss we have had in Canada at $1.4 Billion, reinsurers paid two-thirds. In a $10 Billion British Columbia earthquake, reinsurers would probably pay between 80% and 90%.

There have been substantial changes in the reinsurance market in Canada in the 1990's as well, some of them mirroring those of the insurance market, such as consolidation, but others which have a life of their own, for example, violent swings in catastrophe pricing. This chart shows the change in rates for catastrophe coverage in Canada, as calculated by Swiss Re Canada from a base year of 1990 to 1998.



The peak was reached in 1994, when the top layers of coverage were costing almost three times what they were costing in 1990. The prices have dropped substantially since then and, when 1999 is added, I would expect it to show that the trend of recent years has continued, although perhaps begun to flatten.

If we had a chart showing the catastrophe capacity available in Canada for the same period, it would look something like this one upside-down. Prices increased as capacity dried up, so that in 1993, we were looking at total capacity per reinsurance program of no more than $500 Million. Today we could place $1.5 Billion and the price per million would be at most two-thirds of what an insurance company would have paid for its $500 Million five years ago.

A major difference is in the markets which would be used. A lot of the capacity today comes from reinsurers which did not exist at the beginning of the decade, mainly located in Bermuda. However, the market is still volatile, with a number of takeovers having happened in the Bermuda market. More dramatic has been the rise and fall of the Australian market. Hardly known as a catastrophe reinsurance market five years ago, a couple of years ago it had become one of the major catastrophe reinsurance centres in the world, but is now in the process of returning back to its pre-1995 state.

In addition to this huge conventional capacity available for Canadian insurers, there are a variety of alternatives or add-ons which would be available, were there any demand for them in Canada. They have been used in the United States, Europe and Japan and are developing rapidly in form as new ideas emerge and existing ones are customized for individual needs.

The convergence of the reinsurance and capital markets industries is occurring slowly and is still far from being well established. Even in those countries where capital markets products have been successfully used, there have not been enough for them to become a commodity, which is what has happened to catastrophe reinsurance over the last ten years. Each product is custom-made to the individual circumstances, rather than pulled off the shelf, so it is difficult to give generic examples of what can be done.

The products vary from small modifications to traditional reinsurance to products where reinsurance is not evident at all.

An example of the former would be multiple trigger reinsurance products. For example, catastrophe reinsurance can be structured so that, even if there is a catastrophe loss, there are no recoveries unless some other set of circumstances also prevails. This could be simply a requirement that the catastrophe loss, uncollected, would push the company's combined ratio over a certain level. After all, if an insurer makes a profit after collecting a catastrophe loss, part of that loss recovery will flow straight through to the taxman.

Another situation could be a company which believes it can survive a catastrophe loss so long as that is all that happens, but would have a problem if it happened in the same year as a collapse in the stock market. The catastrophe reinsurance could be structured so that it would only pay if a catastrophe occurred in a year when the value of a pre-determined stock index fell by a certain percentage. This is where both the reinsurance and capital markets can come into play on the same cover, since the reinsurer can take on the catastrophe risk and reduce its exposure by hedging against the drop in the stock index chosen. Similar structures can be used for other exposures, such as investment yield protection.

Capital market products not involving reinsurance, although sometimes looking like it, generally fall into either pre-funding or post-funding products. An example of a pre-funding product would be a catastrophe bond, which is sold by the insurer in the normal course of business, but contains a provision which would change the terms of the bond should a specified event occur, for example a British Columbia earthquake of 6 or greater on the Richter Scale. Such an event could relieve the insurer of the obligation to repay the bond, or delay repayment and give an interest holiday. Again, the actual form of the bond would be tailored to the specific needs of the insurer.

Bonds can also be used for post-funding, for example an insurer arranging in advance for an investor to buy bonds of a specific value at a pre-determined interest rate, should the catastrophic event occur. The advantage here is two-fold – first, guaranteed funds and second, an interest rate which could be considerably lower than what will be available after the event.

These approaches are based on replacing the capital lost in a catastrophe, while reinsurance is designed to protect the capital from erosion in the same event. Since capital replacement is the goal, it can be done through capital itself rather than bonds. The "Cat-E-Put" developed by Aon in the United States gives the insurer an option to issue preferred shares to an investor should the catastrophe take place. These preferred shares would be convertible to common shares after a certain period, but in practice the intention would be that they be redeemed by the insurance company before conversion takes place.

Again, since these products are custom-made to individual circumstances, there are a variety of other forms they take but the goal is still the same, and it is the original goal of catastrophe reinsurance – to permit the insurer to pay its losses and continue providing protection to the community.

In talking about the insurance industry, I have concentrated primarily on what it does after the event. However, it can also play a role in loss mitigation through its underwriting and pricing policies. It is unfortunate that the pricing for earthquake insurance is not as sophisticated as it has become for other forms of insurance. If we could achieve this, then differential pricing based on the exposure to earthquake loss could be used to encourage loss mitigation. Insurance premium credits could be given where buildings are retrofitted to improve their earthquake resistance, or where alternate suppliers are clearly identified to reduce the business interruption exposure. As with car insurance, those more likely to have a loss pay more, those less likely pay less. As a partner with others with a vested interest in loss mitigation, the insurance industry should be able to tailor such pricing initiatives towards the goal the community as a whole has set for itself.

To sum up, the news from the insurance industry, as far as concerns earthquake protection, is good. There is plenty of affordable insurance capacity available, backed up by plenty of affordable reinsurance capacity. If this should change, there are plenty of alternatives in the capital markets ready to fill the gap.

But we must be careful not to let this make us complacent. A major catastrophe somewhere else in the world, or a financial meltdown, perhaps in an over valued stock market, can change the picture quickly. Even if it does not change, we have to remember that values at risk are always increasing. Even if no new building were ever put up in Vancouver, the values inside the existing buildings would continue to rise. In factories, people, who are not insured by the property/casualty industry, are replaced by robots which are. In offices, workers who used to need a couple of dollars worth of pencils and pads now need $5,000 worth of computer equipment.

So while the insurance industry can help us put things back together after an earthquake, and should be able to do so for many years to come, loss mitigation remains a much better solution than loss recovery.