

Economic Insights

The Great East Japan Earthquake: lessons learned, 10 years on

Key takeaways

- The 2011 earthquake exceeded assumptions of Japan's authorities in terms of magnitude and ground motion intensity.
- Total economic losses from the quake and ensuing tsunami were the highest ever resulting from any natural catastrophe in the world.
- The experience has led to the strengthening of already-high standards of disaster mitigation in Japan.
- It also prompted insurers to embed secondary perils like tsunami in catastrophe modelling for better risk assessment.
- Even so, the earthquake protection gap in Japan is USD 25 billion, the second largest in the world.
- Insurers need to extend their reach if they are to help households and businesses be more resilient against earthquake risk in the future.

About Economic Insights

Analysis of key economic developments and their implications for the global re/insurance industry.

Managing Editor

Jérôme Haegeli
Swiss Re Group Chief Economist

Author

Lucia Bevere
Senior Catastrophe Data Analyst

We welcome your feedback. For any comments or questions, please contact: institute@swissre.com

In a nutshell

The Great East Japan Earthquake in 2011 and ensuing tsunami took more than 18 000 lives and wreaked untold damage. The experience has led to a strengthening of what were Japan's already-high standards of disaster mitigation. Insurers too have rethought their risk assessment models, specifically to better factor in perils like tsunami. Nevertheless, a seismic protection gap of USD 25 billion points to a still-large loss potential facing Japan.

On 11 March 2011, a magnitude 9.0 earthquake struck off the Pacific coast of eastern Japan. It was the most powerful known earthquake ever to hit the country and the 4th strongest worldwide. An ensuing tsunami flooded 500 km² of the coastal region from Hokkaido to Okinawa – more than any tsunami ever – causing untold damage. One consequence was the meltdown of a reactor at the Fukushima Daiichi nuclear power plant, which significantly added to the short- and long-term impacts.¹ More than 18 000 people lost their lives or went missing,² making it the deadliest seismic event in Japan since the Great Tokyo earthquake of 1923. Ten years on, the experience has led to many further developments with respect to disaster response and pre-emptive risk mitigation. Nevertheless, due to a combination of factors, existing seismic exposures in Japan could still lead to very large loss tolls.

Japan is one of the most earthquake-prone countries in the world. As a result, building codes there have long been rigorous and strictly enforced. A strong culture of risk prevention and preparedness explains the limited scale of losses resulting from GEJE ground shake relative to the magnitude of the seismic event itself. Most of the deaths and approximately one third of the economic damage were caused not by the quake but by the follow-on tsunami, with cascading effects across critical infrastructure and large-scale disruption of supply chains. At the time of disaster, Japan was already equipped with well-functioning and effective early warning systems and dykes. However, the sheer magnitude of the multiple hazards that struck, such as the tsunami waves that were higher than the dykes, made the event the costliest ever natural catastrophe in world history: economic losses totaled USD 210 billion.

Today reconstruction is mostly complete. The event prompted a massive government disaster-relief response.³ One lesson learned is that today, Japan includes very low frequency but high-impact worst case scenarios for earthquake and tsunami in national planning, mitigating disaster risk to the greatest possible extent. For instance, the height of seawalls has been increased to make mitigation readiness even higher today than 10 years ago.

Insurance claims covered USD 35 billion of the losses resulting from the GEJE

¹F.Ranghieri, M.Ishiwatari, *Learning from megadisasters: lessons from the GEJE*, World Bank 2014.

²*Police Countermeasures and Damage Situation associated with 2011 Tohoku district - off the Pacific Ocean Earthquake*, National Policy Agency of Japan, December 2020.

³F.Ranghieri, M.Ishiwatari, op. cit.

and tsunamis. Although that is the world's largest aggregate insurance industry payout for a seismic event ever, the compensation covered just 16% of all losses. The majority of the claims were paid quickly (within three months) but even so, there were big learnings for the industry too. Not least, at the time the assumed maximum magnitude of an earthquake in the Tohoku region was 8.5,⁴ with tsunami potential modelled on that basis. At 9.0 magnitude, on this occasion reality was worse than ever considered possible. Equally sobering is that the GEJE experience is not necessarily the worst-case scenario that Japan could face. If a similar magnitude earthquake were to strike more areas of more dense population and value concentration (eg, Tokyo), the human toll and economic fallout could be much more extreme.

Despite advancements in seismic science, often the scale of associated loss potential from earthquake events is not fully recognized, even in countries with a long recorded seismic history like Japan. For example, in 2011, while enforced building codes saved lives, there was severe damage to non-structural construction components like ducting, pipework, suspended ceilings and electrical equipment, inflating claims beyond expectations.

Following the GEJE, insurance industry modelling of secondary perils like tsunami and, in the case of New Zealand, liquefaction, and also of the loss potential of buildings' non-structural elements has progressed. As modelling of all loss drivers improves and mitigation of worst-case scenarios is strengthened, the industry will be able to contribute more to offload earthquake risk from businesses and households. We estimate that the natural catastrophe protection gap in Japan in 2019 was more than USD 30 billion in premium equivalent terms, the second highest in the world. Most of the gap – USD 25 billion – came from underinsurance of seismic risk.

Insurance penetration for seismic risks in Japan remains low. In 2011, only 36% of large corporations and less than 10% of SMEs had earthquake cover.⁵ Today, the share has risen but the majority of firms still lack protection. With respect to households, an estimated 50% to 60% have earthquake insurance.⁶ However, with coverage limits in residential policies ranging from 20-50% of fire sum insured, the share of overall losses compensated for is around 15%. That's up from 3% at the time of the 1995 Kobe quake, but is well below levels in other also earthquake-prone countries like Chile (30%) and New Zealand (75%). These discrepancies suggest there is still more to do to extend the reach of earthquake covers across Japan.

Figure 1
The GEJE loss experience in numbers

Deaths	15 899
Missing	2 527
Injured	6 157
Homeless	
March 2011	470 000
Dec 2020	42 000
Dwellings	
Destroyed	121 922
Severely damaged	282 920
Partially damaged	730 392
Losses, USDbn	
Economic	210
Insured	35

Source: National Police Agency of Japan, Reconstruction Agency

⁴ *Response to the 2011 Great East Japan Earthquake and Tsunami disaster*, The Royal Society, 28 October 2015.

⁵ *Towards improvement of disaster risk management capacity of Japan's economy*, Japan Cabinet Office, April 2017.

⁶ Data from AXCO.

© 2021 Swiss Re. All rights reserved. The content of this report is subject to copyright with all rights reserved. The information may be used for private or internal purposes, provided that any copyright or other proprietary notices are not removed. Electronic reuse of the content of this report is prohibited. Reproduction in whole or in part or use for any public purpose is only permitted with the prior written approval of Swiss Re, and if the source reference is indicated. Courtesy copies are appreciated. Swiss Re gives no advice and makes no investment recommendation to buy, sell or otherwise deal in securities or investments whatsoever. This document does not constitute an invitation to effect any transaction in securities or make investments. Although all the information used in this report was taken from reliable sources, Swiss Re does not accept any responsibility for the accuracy or comprehensiveness of the information given or forward looking statements made. The information provided and forward-looking statements made are for informational purposes only and in no way constitute or should be taken to reflect Swiss Re's position, in particular in relation to any ongoing or future dispute. In no event shall Swiss Re be liable for any loss or damage arising in connection with the use of this information and readers are cautioned not to place undue reliance on forward-looking statements. Swiss Re undertakes no obligation to publicly revise or update any forward-looking statements, whether as a result of new information, future events or otherwise.