Better Land-Use and Insurance to Mitigate Natural Disasters

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The rising costs of natural disasters over the last decades are largely explained by urbanisation in exposed areas. Land-use and insurance policies can limit this urbanisation. Simple frequently-observed policies, with prohibited red zones and zones without insurance tariff differentiation, are relatively efficient. It is critical that red zones be redefined to reflect changes in climate risks or population developments.

Chart 1: New Orleans

Source: pixabay.com

Urbanisation in exposed areas and solutions provided by land-use and insurance policies

The global economic costs of natural disasters have risen dramatically over the last decades, reaching USD 190 billion in 2020, against USD 1.3 billion in 1970 (at 2020 prices) (Sigma, 2021). Besides the increasing importance of climate change, this trend is largely explained by the growing number of people and businesses located in exposed areas and the value of their assets (Hallegatte, 2012). For example, in Florida, in 2012, 80%, or USD 2.9 trillion, of the insured

assets were already located near the coasts. In China, in 2004, 50% of the population and two-thirds of the agricultural and industrial product value were concentrated in the 8% of the land area located in the mid- and downstream parts of the seven major flood-prone rivers.

This growing urbanisation in exposed areas is partly due to amenities linked to risk: riversides are attractive. Perception biases, such as underestimating risk or forgetting past events, play their roles. Local public authorities may also fail to communicate on actual risks for fear that the attractiveness or the value of real estate assets might be adversely affected. Economic incentives matter: when households who settle in exposed areas do not have to bear the full cost of the risk as it is not priced into insurance contracts, this favours urbanisation. Our focus here and in our article (Grislain-Letrémy and Villeneuve, 2019) is on this type of free-riding. We limit our scope to the non-life losses from these disasters.

The solutions to control urbanisation in exposed areas combine land-use and insurance policies. Land-use policies sometimes lead to decisive actions, such as the acquisition by the Federal Emergency Management Agency of nearly 4,500 flood-prone homes in Missouri after the 1993 Great Flood. Insurance policies can also limit free-riding by making households and businesses located in exposed areas pay for the risk they take. For example, the earthquake insurance premiums in Japan or the flood insurance premiums in the United States increase with respect to the risk exposure. Even in these cases, the premium increase is regulated.

Risk capitalisation in property values and the impact of insurance prices

Asset values should reflect differences in risk. Thus, the value of property in a flood zone is depreciated by the real estate market. If insurance is available, the negative capitalisation originates from insurance premiums. Empirical studies based on the hedonic price method confirm that real estate markets value the capitalised flow of disaster insurance premiums (Bin et al., 2008, Harrison et al., 2001, MacDonald et al., 1990). Experience shows that real estate prices react more to insurance premiums revisions than to other risk revelations (Skantz and Strickland, 1987).

Insurance is often location-blind. The first type is disaster assistance by the state in Australia, China, and in many European countries, where private insurance is either non-existent or purchased by few households or firms. The second type is the legally non-discriminatory insurance pricing, such as in Denmark, France, Spain, or Switzerland. In most countries, this inefficient pricing of either of the two types is accompanied by construction prohibition.

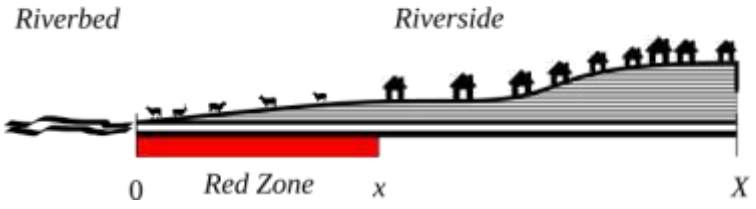
Under location-blind insurance, and assuming that the insurance is complete, then all the properties become artificially equivalent, leading to greater urbanisation of the most risky places. In practice, this negative effect is somewhat mitigated by the fact that insurance is in reality incomplete.

A typical result of economic analysis is that the insurance premiums (price incentives) are, in principle, as efficient as the zoning approach (quantity regulation). Actually, prices and zoning are even substitutes at any scale. Zoning can increase degrees of efficiency in a territory uniformly treated by insurance; insurance tariff differentiations can make up for the imperfection of zoning.

Examining the power of red zone policies

We investigate the most commonly observed policies with a prohibited red zone and a building zone without insurance tariff differentiation.

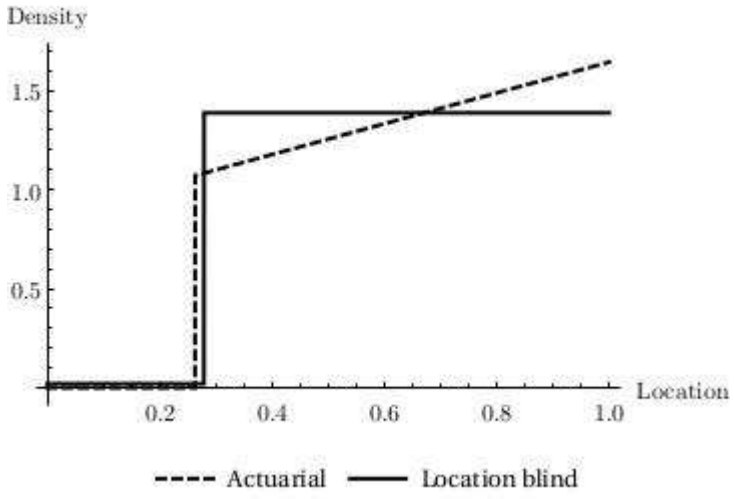
Chart 2: Red zone



Source: Grislain-Letrémy and Villeneuve (2019)

Our simulations illustrate that the red-zone policy is relatively efficient. Location-blind premiums lead to uniform use of the whole authorised space (Chart 3, solid line); actuarially fair insurance provides smooth incentives for households to concentrate in less risky areas (dashed line). Under actuarially fair insurance, the riskiest areas are spontaneously deserted. This zone is only slightly smaller than the optimal red zone.

Chart 3: Equilibriums: actuarially fair premiums vs location-blind premiums and optimal red zone



Source: Grislain-Letrémy and Villeneuve (2019)

What happens when risk changes?

Updating the zoning as risk changes is crucial. Climate change will increase the intensity and the frequency of natural disasters. Global flood damage for large coastal cities is expected to increase eightfold between 2005 and 2050, with projections based only on increasing population and property value. Once climate change and subsidence added, global flood damage for large coastal cities could increase 19-fold and cost USD 1 trillion a year if prevention is not upgraded (Hallegatte *et al.*, 2013).

We determine the impacts of climate change and demographic pressure on optimal red zones. As expected, extending the red zone as disaster frequency or seriousness increase would limit the final impact. In contrast, a population increase raises the risk but increases the demand for land at the same time. Optimal red zones can decrease or increase as the population grows.

Difficulties in managing people and dwellings already in exposed areas

How should people and assets already located in highly exposed areas be dealt with? Incentivising would be a pitfall here: it is tempting to exonerate existing dwellings of the unfavourable revision of risk exposure. Grandfather rights, widely taken up, lead to repeated losses. There should instead be a clear risk revision, accompanied by an evolution of insurance compensation from a pay-to-rebuild to a pay-to-move principle.

This blogpost comes from the VoxEU column published on April 27, 2022.