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Cost-Benefit Analysis of individual adaptation to floods

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Floods may pose a risk if there exist populations, activities, or goods that are exposed and vulnerable to these hazards. Thus, to limit a risk of flooding, either the hazard, the number of people, activities or goods that are exposed to it, or their vulnerability to floods can be targeted. On the one hand, flood defences, such as dikes, aim to lower the probability of flooding. On the other hand, zoning policies, warning systems, emergency aid, and insurance schemes are used to reduce the number of exposed elements or their vulnerability. While it is common practice to assess the cost-efficiency of flood defences in order to help policy-makers design efficient flood management policies, few studies evaluate the cost and efficacy of the policies that aim to reduce the exposition and/or vulnerability to floods.

We contribute to fill this gap by studying a zoning policy implemented at the municipality level in France and called the Flood Risk Prevention Plan. This policy delineates areas where measures aimed at reducing the vulnerability of the dwellings to floods are recommended or mandatory. We performed the cost-benefit analysis of 4 measures recommended or mandatory for some dwellings located in the Argens watershed in the South of France: a measure that consists in dry-proofing the dwelling, one that consists in using water-resistant materials for the building, one that combines dry-proofing and the use of water-resistant materials, and one that consists in forbidding new constructions in specific areas.

To perform the cost-benefit analysis, we first combined computer modelling and expert judgement to obtain damage functions with and without each measure and functions that indicate the installation cost of the measures. Then, we used existing spatial databases to locate the dwellings concerned by each measure and estimate the water depth for several return periods. We associated damage and cost functions to each dwelling depending on its type and date of construction. We could thus estimate, for each concerned dwelling, the damage avoided thanks to each measure for several return periods and the installation cost of the measure. For each measure and each dwelling, we compared the installation cost and the discounted sum of avoided damage to assess the cost-efficiency of the measure. To assess the cost of the measure that consists in forbidding new constructions, we have to identify alternative locations where people could build their dwellings and estimate the associated opportunity costs.

Our main results are that dry-proofing can only be cost-efficient for dwellings that are exposed to frequent floods (floods with a return period of 50 years or less) and that it is often cost-efficient to use water-resistant materials for new dwellings because these materials are often less expensive that the ones that are usually used in France. The cost-efficiency of the measure that consists in forbidding new constructions depends on the opportunity cost of settling in another location.