

# TREATMENT OF UNCERTAINTY IN BENEFIT-COST ANALYSES OF RISK-REDUCTION PROJECTS

## Authors

Xavier Le Den, Jakob Louis Pedersen, Fredrik Hahn, Thomas Neumann, Chiara Pancotti, Silvia Vignetti

## Areas

1. Risk and uncertainty
2. BCA – Implementation: Challenges/Practices
3. Environment – General...

## Keywords

risk, uncertainty, empirical, eu, guidelines

## Research question

The present paper grew out of a study commissioned by the European Commission to evaluate the costs and the benefits of 10 major environmental infrastructure projects ex-post their implementation. Two of the evaluated projects entailed the reduction of the vulnerability and exposure of infrastructure and ecosystems to natural and human-induced hazards. The ambition of this paper is to illuminate the issues that arise in cost-benefit analyses of risk reduction projects ex-post and give suggestions as to how these can be addressed in national guidelines, based on empirical research. The views expressed in this paper are those of the authors and not of the European Commission.

## Methodology

This paper draws lessons from the cost-benefit analyses carried out in lieu of the European Commission study. To ensure a consistent approach to monetising the costs and benefits arising from each project, a common assessment framework was set up based on a literature review of the EU Cost-Benefit Analysis Guidelines 2014 and other national cost-benefit guidelines in Europe. The framework identifies the most likely impacts of risk reduction projects and specifies their respective methods for quantification. It was then applied to a project protecting a beach from coastal erosion in Southern France via the implementation of soft wave attenuators as well as a project commissioning a ship specialised in combating oil spills in the Baltic Sea.

## Expected results

The estimated net benefits of risk reduction projects are sensitive to the assumed damage function of the respective hazards (e.g. disaster recurrence rate, associated damage costs and exposure and vulnerability of infrastructure). By extension, the results are dependent on the availability and quality of risk models and their integration into the analysis. Low resolution of the available risk assessments may create uncertainty with respect to the accuracy of the estimated costs and benefits for risk reduction projects.

In this regard, there currently is no systematic treatment of the uncertainty in risk models stemming from scarcity of data in EU cost-benefit analysis guides. We argue that for risk reduction projects, there is a need to expand and develop the current methodological approaches by i) suggesting specific parameters and reference values (e.g. the time horizon, the social discount rate, the unit damage costs) valid in an EU context on the basis of available studies and research evidence, and ii) providing a standardised approach to including risk modelling into CBA in a systematic way.

## References

- Botzen, W.J.W., Monteiro, É., Estrada, F., Pesaro, G., et al. (2017) Economic Assessment of Mitigating Damage of Flood Events: Cost-Benefit Analysis of Flood-Proofing Commercial Buildings in Umbria, Italy. *The Geneva Papers on Risk and Insurance - Issues and Practice*. [Online] 42 (4), 585–608. Available at: doi:[10.1057/s41288-017-0065-0](https://doi.org/10.1057/s41288-017-0065-0).
- Chiabai, A., Hunt, A., Galarraga, I., Lago, M., et al. (2015) *Using cost and benefits to assess adaptation options*
- Hallegatte, S. (2014) *Economic Resilience: Definition and Measurement*. Policy Research Working Papers. [Online]. The World Bank. Available at: doi:[10.1596/1813-9450-6852](https://doi.org/10.1596/1813-9450-6852) (Accessed: 22 June 2018).
- Kousky, C. (2014) Informing climate adaptation: A review of the economic costs of natural disasters. *Energy Economics*. [Online] 46: 46576–592. Available at: doi:[10.1016/j.eneco.2013.09.029](https://doi.org/10.1016/j.eneco.2013.09.029).
- Mechler, R. (2016) Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost-benefit analysis. *Natural Hazards*. [Online] 81 (3), 2121–2147. Available at: doi:[10.1007/s11069-016-2170-y](https://doi.org/10.1007/s11069-016-2170-y).
- Meyer, V., Becker, N., Markantonis, V., Schwarze, R., et al. (2013) Review article: Assessing the costs of natural hazards – state of the art and knowledge gaps. *Natural Hazards and Earth System Sciences*. [Online] 13 (5), 1351–1373. Available at: doi:[10.5194/nhess-13-1351-2013](https://doi.org/10.5194/nhess-13-1351-2013).
- Navrud, S., Lindhjem, H. and Magnussen, K. (2016) Valuing Marine Ecosystem Services Loss from Oil Spills for Use in Cost-Benefit Analysis of Preventive Measures. In: *Handbook on the Economics and Management for Sustainable Oceans*. Cheltenham, Edward Elgar Publishing. p.
- Pindyck, R.S. (2017) The Use and Misuse of Models for Climate Policy. *Review of Environmental Economics and Policy*. [Online] 11 (1), 100–114. Available at: doi:[10.1093/reep/rew012](https://doi.org/10.1093/reep/rew012).
- Price, R. (2018) *Cost-effectiveness of disaster risk reduction and adaptation to climate change* [Online]. p.21. Available at: [https://assets.publishing.service.gov.uk/media/5ab0debce5274a5e20ffe268/274\\_DRR\\_CAA\\_cost\\_effectiveness.pdf](https://assets.publishing.service.gov.uk/media/5ab0debce5274a5e20ffe268/274_DRR_CAA_cost_effectiveness.pdf).
- Shreve, C.M. and Kelman, I. (2014) Does mitigation save? Reviewing cost-benefit analyses of disaster risk reduction. *International Journal of Disaster Risk Reduction*. [Online] 10213–235. Available at: doi:[10.1016/j.ijdrr.2014.08.004](https://doi.org/10.1016/j.ijdrr.2014.08.004).
- Tol, R.S.J. (2018) The Economic Impacts of Climate Change. *Review of Environmental Economics and Policy*. [Online] 12 (1), 4–25. Available at: doi:[10.1093/reep/rex027](https://doi.org/10.1093/reep/rex027).