

KNOW YOUR CORRELATION IMPACTS: AN INTERACTIVE GAME [Introductory level]

Title: *Will I fail? It depends!*

Format: To do this exercise, follow the guidance in [Will_I_Fail_Guidance_1.10_participant.docx](#) and use the structured EXCEL sheet [Will_I_fail_EXCEL_1.4_participant.xlsx](#). For answers please see [Will_I_Fail_Guidance_1.10_answers.docx](#), with a completed version of the Tasks in [Will_I_fail_EXCEL_1.4_answers.xlsx](#).

Why is the training important: In short, because diversification is the basis of all (re)insurance, and correlation (a.k.a. dependency) destroys diversification. So, it's fundamental. If we get dependency wrong, we mis-estimate risk, mis-price risk etc

Key themes:

1. Raising awareness of dependency (e.g. between hazards, lines of business, peril-regions) What is it? Why does it matter in my day job?
2. The main metrics – Annual average loss (AAL) and 1-in-200 year return period losses.
3. With limited events (observed or simulated), how do we cautiously interpret simulation modelling?

Summary of activity: A dice-rolling game, simulating 6 causes of loss (i.e. possible hazards) and how dependency affects the chance of loss exceeding a threshold.

Level & Audience: Introductory level, for the widest audience. No equations! For relatively new starters in the field of catastrophe risk management, or PhD students studying compound or multi-hazard risk. It can also serve as a reminder to those experienced in modelling dependency.

Duration & date: ~1h of effort.

Take home messages:

- You need evidence a correlation exists (e.g. scientific research).
- Joint AAL is not affected by correlation.
- Severe yet rare, 1-in-200 year RP, joint losses are affected by correlation.
- Be careful to use sufficient simulations! More are needed to constrain these effects than for a single hazard/risk.

Further thoughts

- Many sources of correlation (e.g. storm footprint, linked vulnerability), but how 'baked in' these are to models is often not transparent.
- Inverse correlation between regions, lines of business etc ... might reduce the chance of large losses in a time window (e.g. week).

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Additional Reading: This work is based upon the idea that flooding and wind in the UK are linked rather than dependent (Bloomfield et al., 2023; De Luca et al., 2017; Hillier et al., 2015, 2023).

Bloomfield, H., Hillier, J. K., Griffin, A., Kay, A. L., Shaffrey, L., Pianosi, F., James, R., Kumar, D., Champion, A. J., and Bates, P. D.: Co-occurring wintertime flooding and extreme wind over Europe, from daily to seasonal timescales, *Weather Clim. Extremes*, 39, 100550, <https://doi.org/10.1016/j.wace.2023.100550>, 2023.

De Luca, P., Hillier, J. K., Wilby, R. L., Quinn, N. W., and Harrigan, S.: Extreme multi-basin flooding linked with extra-tropical cyclones, *Env. Res. Lett.*, 12, 114009, <https://doi.org/10.3390/atmos10100577>, 2017.

Hillier, J. K., Macdonald, N., Leckebusch, G. C., and Stavrinos, A.: Interactions between apparently primary weather-driven hazards and their cost, *Env. Res. Lett.*, 10, 104003, <https://doi.org/doi:10.1088/1748-9326/10/10/104003>, 2015.

Hillier, J. K., Perkins, T., Li, R., Bloomfield, H., Lau, J., Claus, S., Harrington, P., Latchman, S., and Humphry, D.: What if it's a perfect storm? Stronger evidence that insurers should account for co-occurring weather hazards, *Bank Underground*, 2023.