

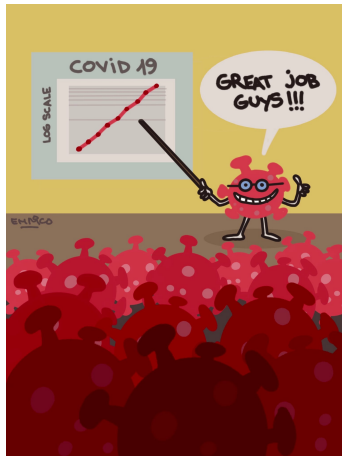
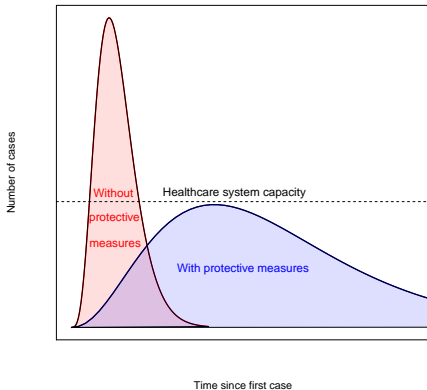
Risk Analytics

Introduction

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2025

Risk Assessment Matters: Health Care Risk and Hospital Congestion



Risk Assessment Matters: Environmental Risk



Source: Cieau

Risk Assessment Matters:

Environmental Risk → Enterprise/Insurance Risk



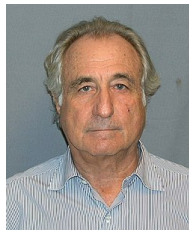
Source: 24 Heures; Rheinland-Pfalz government

Risk Assessment Matters: Cybersecurity/Terrorist Risk → Enterprise/Insurance Risk



Source: Wärtsilä; Business Insider

Risk Assessment Matters: Financial Risk



$$\Pr[T_A < 1, T_B < 1] = \phi_2(\phi^{-1}(F_A(1)), \phi^{-1}(F_B(1)), \gamma)$$

“Recipe for Disaster: The Formula That Killed Wall Street” Wired (2009)

“The World’s Largest Hedge Fund is a Fraud” - 2005 (already)

Risk Assessment Matters:

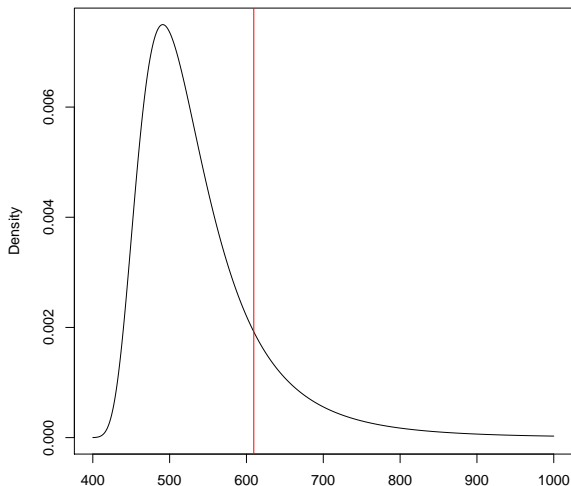
Engineering/Technology Risk → Enterprise/Insurance Risk



Source: Welt; deepsense.ai

Analysis of extreme values

“The devil is in the tails”



Quantitative methods

Example: What is the distribution of the maximum?

(Fisher-Tippett Theorem - 1928)

The GEV has distribution function

$$H_{\mu,\sigma,\xi}(x) = \begin{cases} \exp\left(-\left\{1 + \xi\left(\frac{x-\mu}{\sigma}\right)\right\}^{-1/\xi}\right) & \text{if } \xi \neq 0, \\ \exp\left(-e^{-(x-\mu)/\sigma}\right) & \text{if } \xi = 0, \end{cases}$$

where $1 + \xi(x - \mu)/\sigma > 0$ and ξ is the **shape** parameter. For

$$\left\{ \begin{array}{l} \xi > 0 \\ \xi = 0 \\ \xi < 0 \end{array} \right\} \quad \text{we also say that H is} \quad \left\{ \begin{array}{l} \text{Fréchet} \\ \text{Gumbel} \\ \text{Weibull} \end{array} \right\}.$$

Course organisation

Week	Date	Lecture	Exercises
1	18.09	Workshop week (no RA lecture)	
2	25.09	Introduction + Time series	Practical 1 (TS)
3	02.10	Time series in practice	Practical 1 (TS)
4	09.10	EVT: Block Maxima + Practice (I)	Practical 1 (TS)
5	16.10	EVT: Peaks over threshold	Practical 2 (EVT)
6	23.10	Monitoring and reporting risk	Practical 2 (EVT)
7	30.10	Advanced topics in EVT	Practical 2 (EVT)
8	06.11	EVT in practice (II)	Practical 2 (EVT)
9	13.11	Q & A	Practical 3
10	20.11	Q & A	Practical 3
11	27.11	Q & A	Practical 3
12	04.12	Q & A	Practical 3
13	11.12	Q & A	Practical 3
14	18.12	Presentations	

Course organisation II

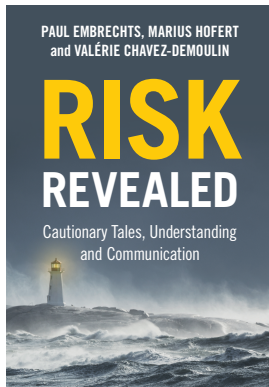
- Lectures and exercise sessions will be given in class. They will not be recorded.
- Practicals will be in groups of 4 to 5.
- Evaluation:
 - One report (for the 3 practicals together) per group, max 10 pages
 - Due **Monday 15.12 at 17.00**, with R code in appendix
 - Presentations of Practical 3 in the last week (15 min. speaking time + 5 min. questions)
 - Grade: report (1/2) + presentation (1/2)
 - No exam

Topics

- Time series
 - ARMA processes
 - GARCH processes
- Extreme value theory
 - Block maxima
 - Peaks over threshold
- Risk measures
 - Return level
 - Value at risk
 - Expected shortfall

Vocabulary, appendices and references

In the upper section of the moodle page, you will find a Vocabulary and References file, in which we try to list the vocabulary used in the Course modules and in which we give further (non-mandatory) reading about each of the topic covered. Feel free to consult this file in case you are unsure about some prior notions of statistics and/or notations you encounter in the slides.



This course requires good notions of statistics and the R language.

Hope you enjoy this course !