Investment in flood protection measures under climate change uncertainty

Karianne de Bruin
Environmental Economics and Natural Resources Group
Wageningen University

Erik Ansink
IVM-VU
Amsterdam

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Elbe (2002)

Dresden

Source: Floodsite (IOER, City of Dresden)

UK flooding (2007)

Source: BBC

Climate change and flooding (1)

"Climate change will pose water management challenges, with increasing risks of floods throughout most of Europe" IPCC (2007)

"Most likely seasonal discharge will shift to more discharge in winter and less discharge in summer … and the frequencies of floods and droughts are expected to increase" Linde et al. (2008) Hydrology and Earth System Sciences

Climate change and flooding (2)

"Although extreme floods with return periods of 100 year and more occurred in central Europe in 1997 (Oder) and 2002 (Elbe), there is no evidence for upward trends in the occurrence of extreme floods in central Europe" Mudelsee et al. (2003) Nature

"Impacts of climate change on the hydrological regime of rivers is still an open question, especially regarding extreme hydrological events such as floods or droughts" Renard et al (2008) Water resources research

Issues

- Floods
- Uncertainty
- Flood protection measures
- Optimal investment strategy

- Example: peak discharge

Model

- Investment in flood protection measures under climate change uncertainty
- Goal: optimal investment strategy

- Discrete two-period model
- Relax discreteness assumption

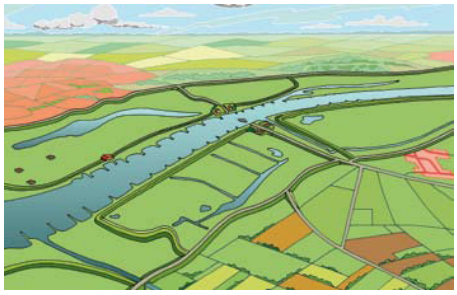
- Adapt model from Hennessy and Moschini (2006)

Structural measures

Flood protection measures in Japan (Tokyo)

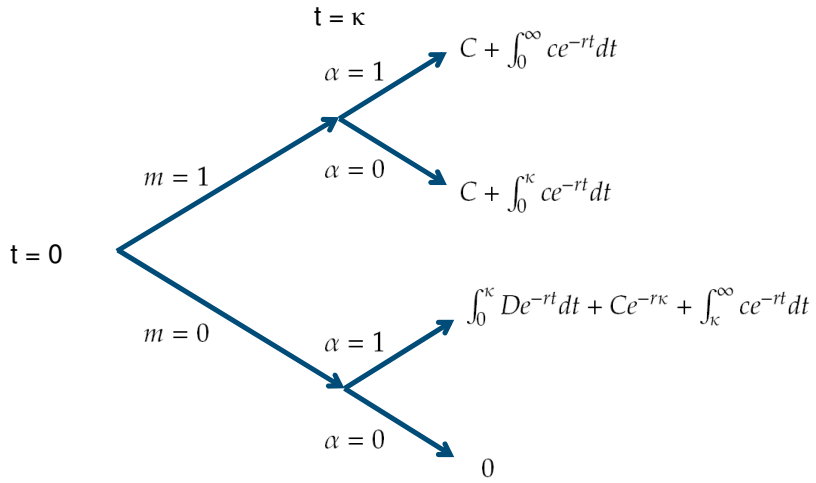
Non-Structural measures

Room for the river (the Netherlands)



Lexkesveer (source: Rijkswaterstaat)

Discrete two-period model



Building blocks – continuous model

2-Period

s_0 & n_0 — s_k & n_k

α = [0:1] — α = known

Building blocks – continuous model

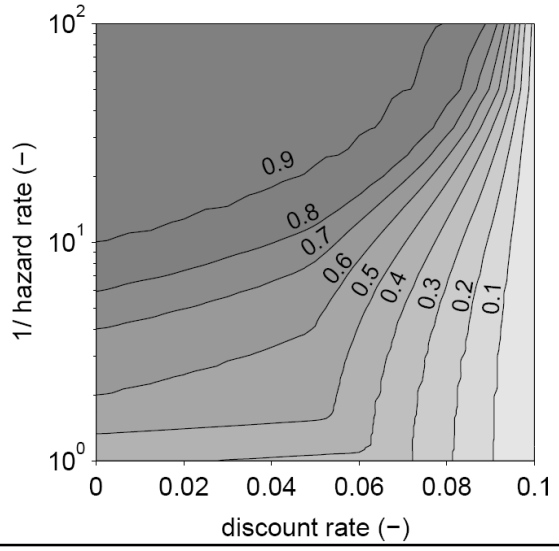
3-Period

s_0 & n_0	s_{k1} & n_{k1}	s_{k1+k2} & n_{k1+k2}
α = [0:1]	α = sub-domain of [0:1]	α = known

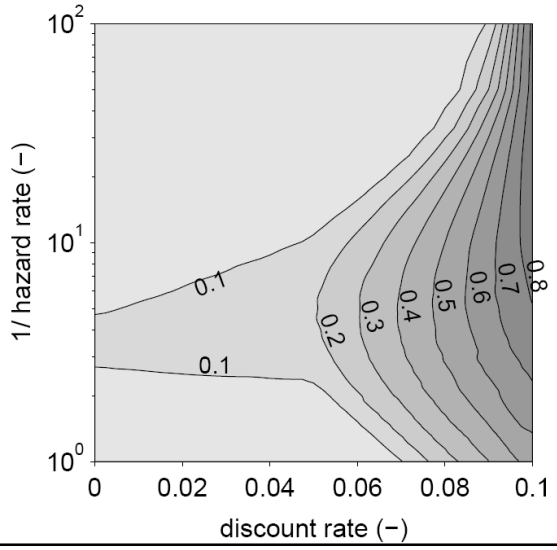
Results

- Investment in structural and non-structural flood protection measures
- Objective: minimise expected costs
- Numerical example 2-period model

Structural



Non-structural

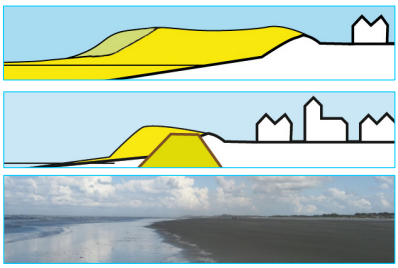


Implications for flood protection

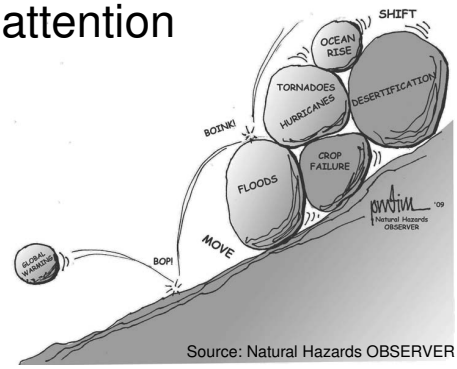
- Structural and non-structural measures
- Waiting for new information

Summary

- Investment in flood protection measures under climate change uncertainty
- Goal: optimal investment strategy
- Discrete model
- Continuous model
- Application to case study



Thank you for your attention



Source: Natural Hazards OBSERVER