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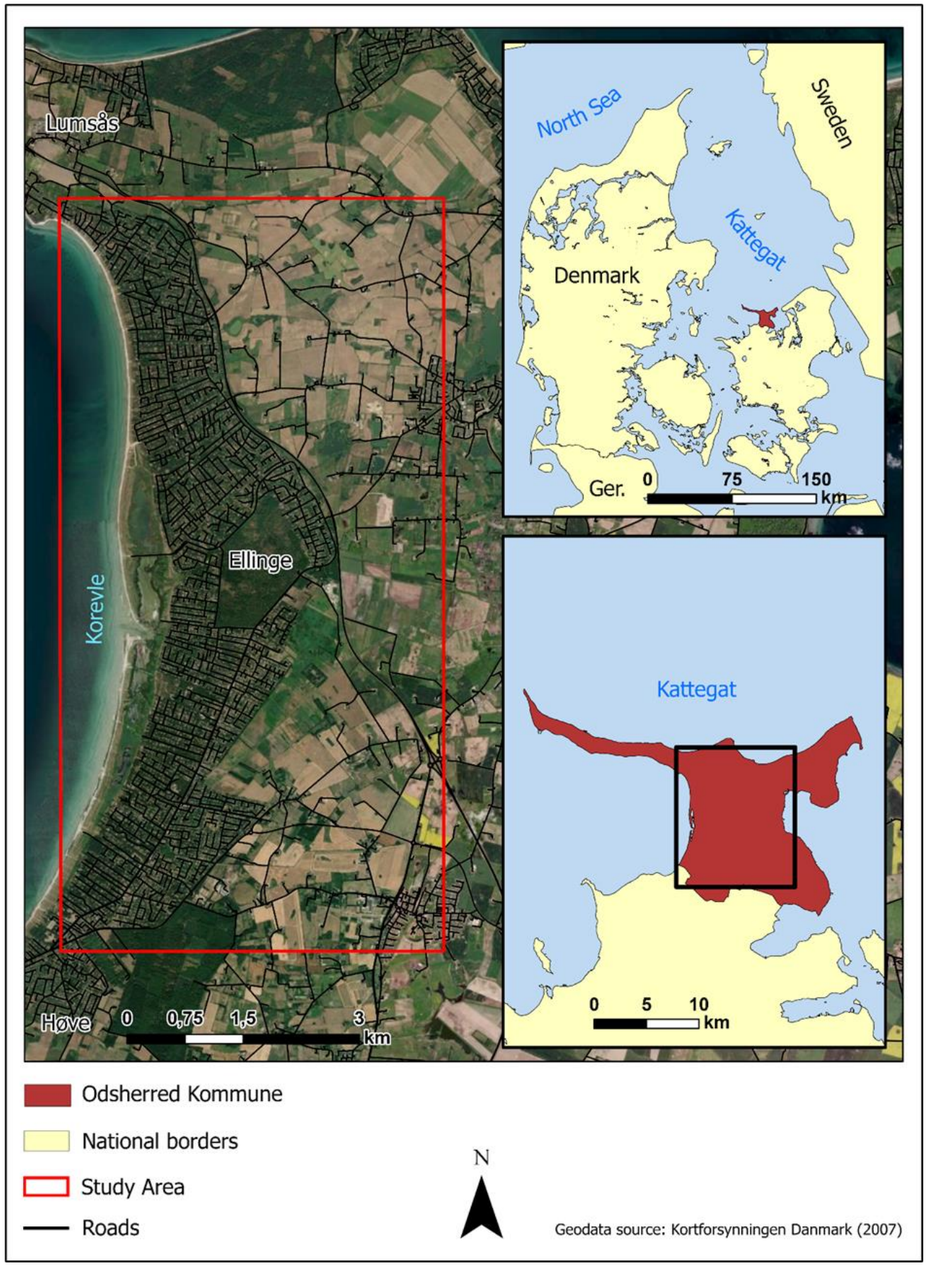
ASSESSING THE RELATION BETWEEN COASTAL FLOOD RISK AND RISK PERCEPTION IN SEJERØ BAY

INTRODUCTION

- Aim: investigate whether experts' risk calculations match local risk perception
- Summerhouse area around Sejerø
- Climate change's effects
- Main parts:
  1. **Expert judgement**
  2. **Local risk perception**



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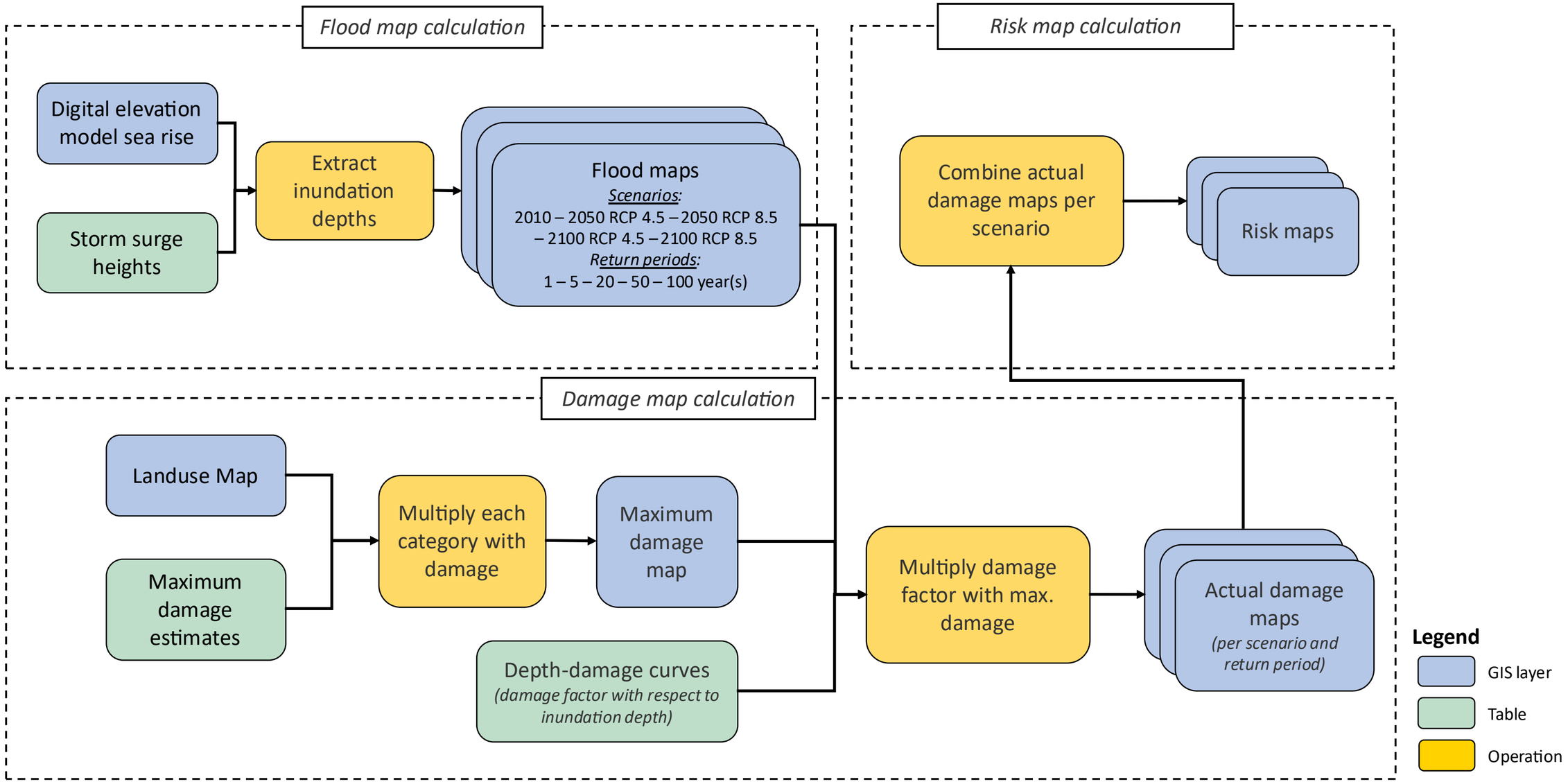
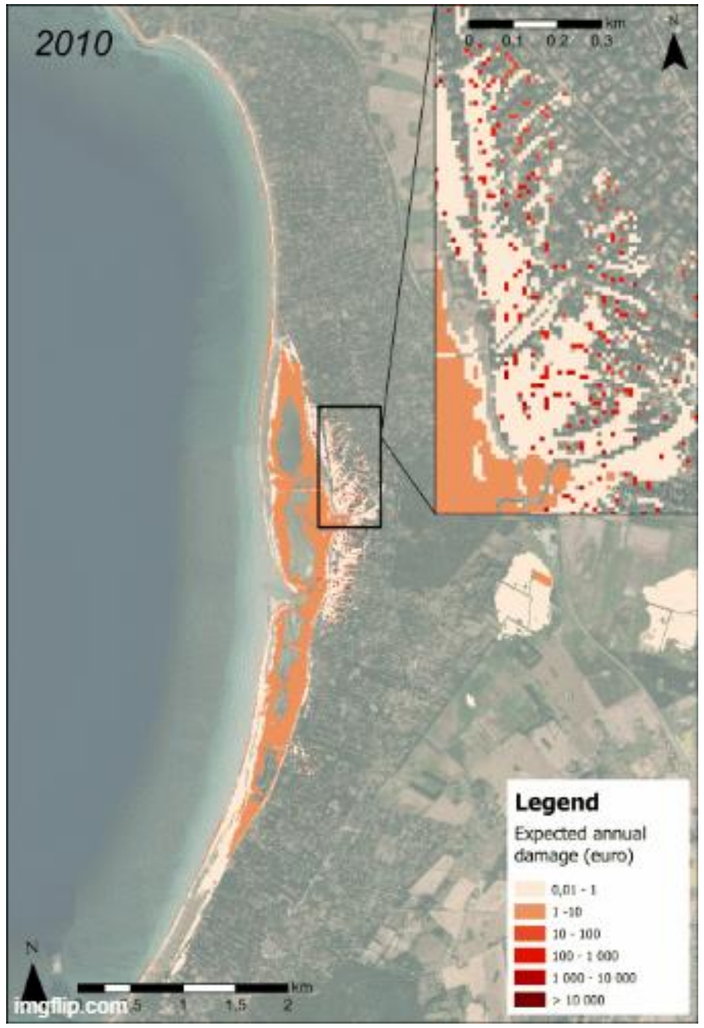
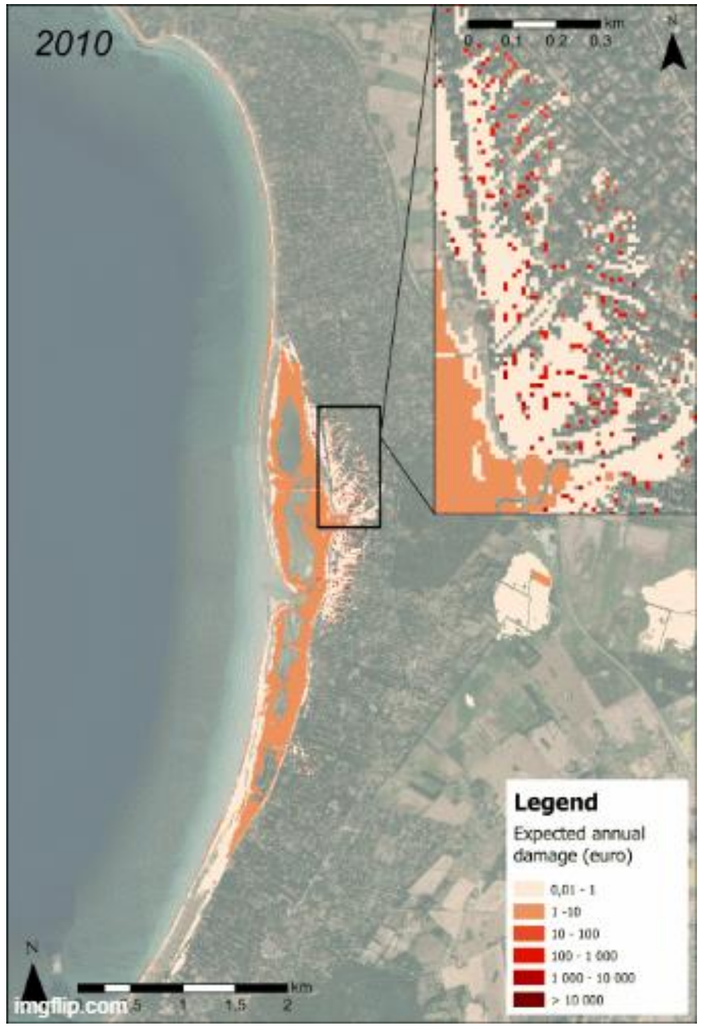
METHOD: EXPERT JUDGEMENT



Based on Kellens et al. 2013

RESULTS: EXPERT JUDGEMENT





Scenario	Total expected annual damage (million euro)
2010	0.49
2050 – RCP 4.5	1.42
2050 – RCP 8.5	1.96
2100 – RCP 4.5	2.54
2100 – RCP 8.5	4.78

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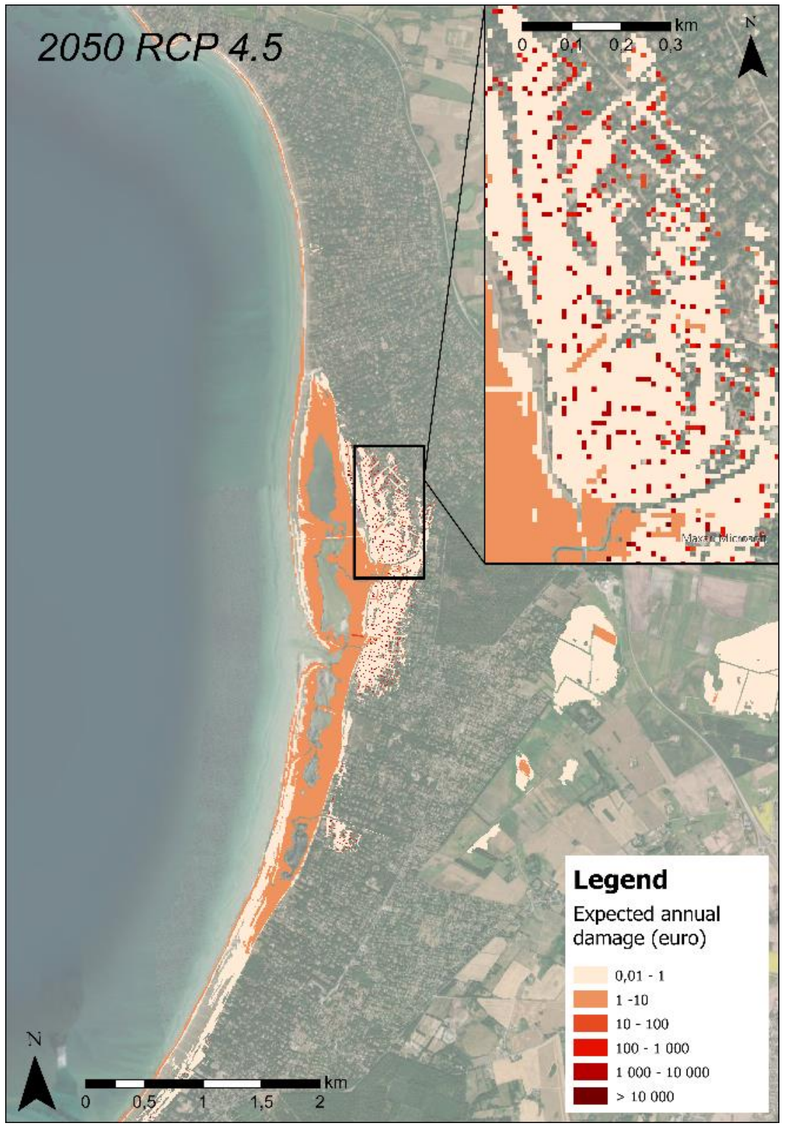
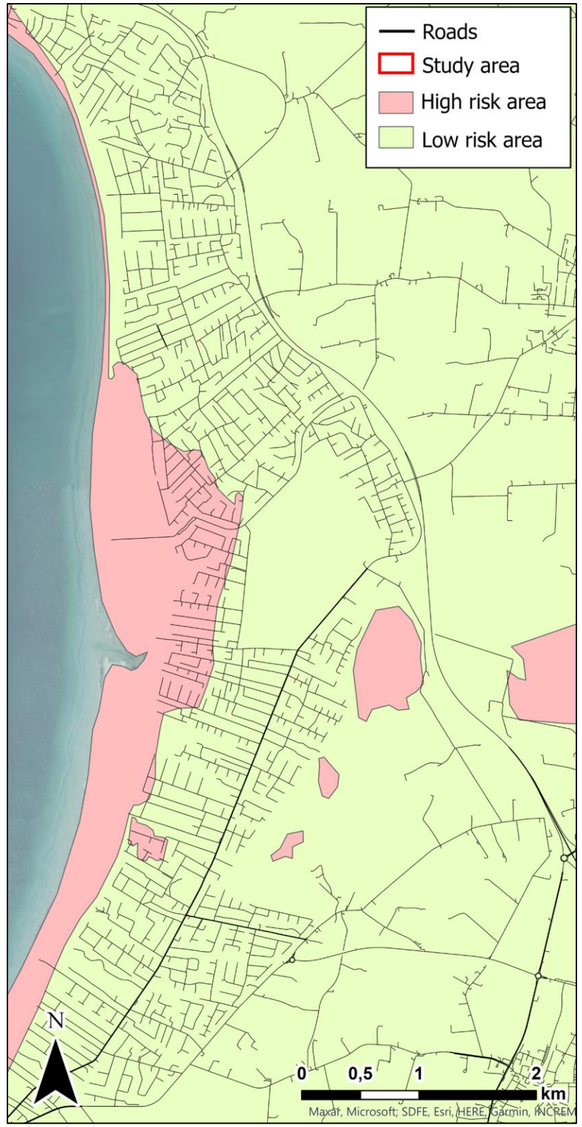
RESULTS: EXPERT JUDGEMENT





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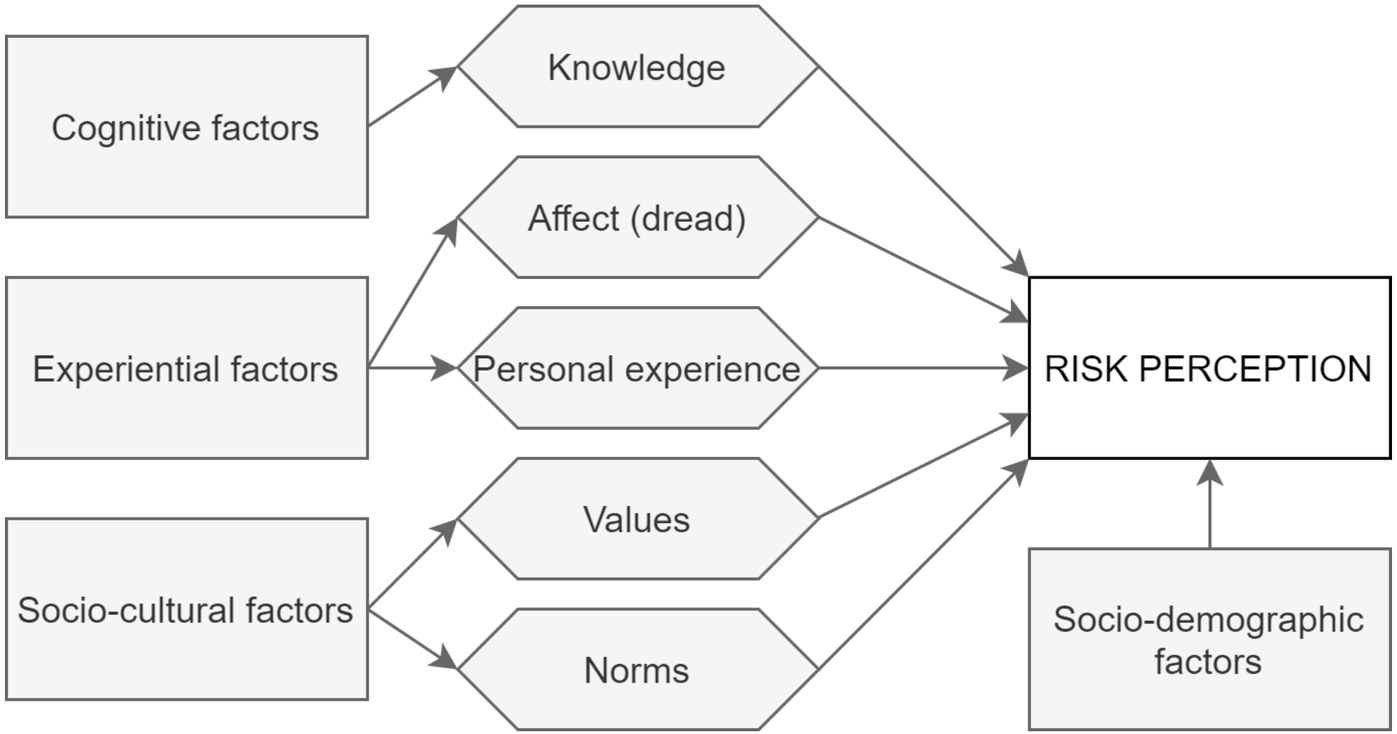
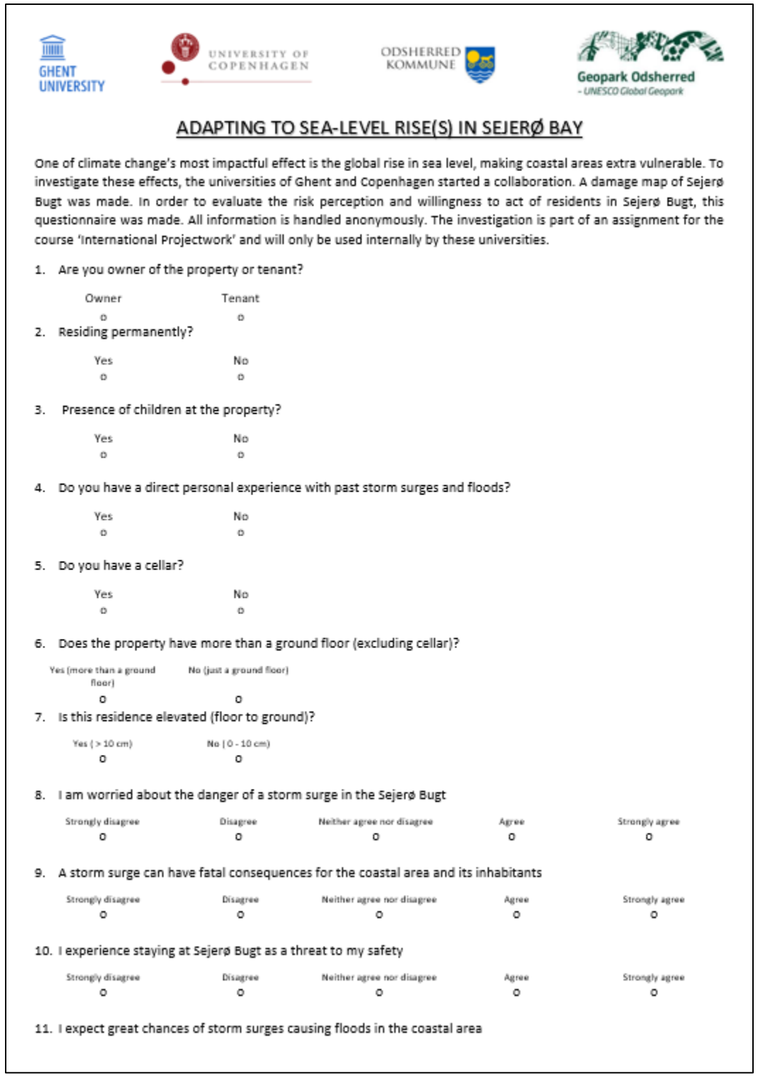
FRAMEWORK: RISK PERCEPTION



van der Linden (2012)

METHOD: SURVEY

- Questionnaire → local risk perception
- ~ interview
- 4 main parts:
  1. Background variables
  2. Risk perception
  3. Willingness to pay
  4. Qualitative analysis



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ADAPTING TO SEA-LEVEL RISE(S) IN SEJERØ BAY

One of climate change's most impactful effect is the global rise in sea level, making coastal areas extra vulnerable. To investigate these effects, the universities of Ghent and Copenhagen started a collaboration. A damage map of Sejerø Bugt was made. In order to evaluate the risk perception and willingness to act of residents in Sejerø Bugt, this questionnaire was made. All information is handled anonymously. The investigation is part of an assignment for the course 'International Projectwork' and will only be used internally by these universities.

1. Are you owner of the property or tenant?

   Owner o Tenant o

2. Residing permanently?

   Yes o No o

3. Presence of children at the property?

   Yes o No o

4. Do you have a direct personal experience with past storm surges and floods?

   Yes o No o

5. Do you have a cellar?

   Yes o No o

6. Does the property have more than a ground floor (excluding cellar)?

   Yes (more than a ground floor) o No (just a ground floor) o

7. Is this residence elevated (floor to ground)?

   Yes (> 10 cm) o No (0 - 10 cm) o

8. I am worried about the danger of a storm surge in the Sejerø Bugt

   Strongly disagree o Disagree o Neither agree nor disagree o Agree o Strongly agree o

9. A storm surge can have fatal consequences for the coastal area and its inhabitants

   Strongly disagree o Disagree o Neither agree nor disagree o Agree o Strongly agree o

10. I experience staying at Sejerø Bugt as a threat to my safety

    Strongly disagree o Disagree o Neither agree nor disagree o Agree o Strongly agree o

11. I expect great chances of storm surges causing floods in the coastal area

Based on Kellens et al. (2011)

METHOD: SURVEY

- N = 82
- Age normally distributed
- More men than women
- Evenly distributed between high and low risk area

Variable	Number	Percentage
Age		
16 - 30	3	3.7
31 - 45	19	23.2
46 - 60	32	39.0
61 - 75	24	29.3
76 - 90	4	4.9
Missing	0	0.0
Gender		
Male	48	58.5
Female	34	41.5
Missing	0	0.0
Cellar		
Yes	3	3.7
No	79	96.3
Missing	0	0.0
Elevated		
Yes (> 10cm)	52	63.4
No	29	35.4
Missing	1	1.2
Risk area		
High	42	51.2
Low	40	48.8
Missing	0	0.0

Variable	Number	Percentage
Education level		
High	70	85.4
Low	12	14.6
Missing	0	0.0
Home ownership		
Owner	68	82.9
Tenant	14	17.1
Missing	0	0.0
Permanent residence		
Yes	9	11.0
No	73	89.0
Missing	0	0.0
Flood experience		
Yes	24	29.3
No	58	70.7
Missing	0	0.0
Ground floor		
Yes	62	75.6
No	19	23.2
Missing	1	1.2
Presence of children		
Yes	65	79.3
No	17	20.7
Missing	0	0.0

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METHOD: RISK PERCEPTION

Question	Dread (personal, emotional)	Knowledge (awareness in general)	Focus of the question
8. I am worried about the danger of a storm surge in the Sejerø Bugt	Local dread: 'in Sejerø Bugt'	Awareness, thought about the danger: 'worried about the danger'	**Dread** and **knowledge**
9. A storm surge can have fatal consequences for the coastal area and its inhabitants	Personal location: 'for the coastal area and its inhabitants'	Awareness, knowing consequences: 'can have fatal consequences'	**Dread** and **knowledge**
10. I experience staying at Sejerø Bugt as a threat to my safety	Personal: 'threat to my safety'	Question implies knowledge about the negative consequences	Mostly **Dread**
11. I expect great chances of storm surges causing floods in the coastal area	Local: 'in the coastal area'	Awareness, risk estimation: 'expect great chances'	Slightly more **knowledge**
12. When I think of floods, I feel concerned	Personal emotions: 'I feel'	General knowledge: 'concerned'	Mostly **knowledge**

Based on Kellens et al. 2011

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METHOD: FACTOR AND REGRESSION ANALYSES

Factor analysis

- Principal axis factoring → exploratory technique
- Cronbach's alpha: 0,597

Regression analyses

- H1: living in high risk area → higher levels of perceived risk
- H2: higher age, female gender, lower education, home ownership and permanent residence → higher levels of perceived risk
- H3: previous flood experience → higher levels of perceived risk

Based on Kellens et al., 2011

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RESULTS & DISCUSSION: FACTOR ANALYSIS

Risk perception:

	Factor 1	Factor 2	
8. worried	.454	.610	→ **Dread** and **knowledge**
9. fatal_consequences	.943		→ **Dread** and **knowledge**
10. threat			→ Mostly **dread**
11. expect_changes		.488	→ Slightly more **knowledge**
12. concerned		.441	→ Mostly **knowledge**

Extraction Method: Principal Axis Factoring.
Rotation Method: Varimax with Kaiser Normalization
Rotation converged in 3 iterations.
Coefficients below 0.4 are supressed.

Apprehension

Awareness

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RESULTS & DISCUSSION: APPREHENSION

- Risk perception < **apprehension** & awareness

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.529	.279		1.897	.062
	Risk area	-.522	.200	-.278	-2.615	.011
	Gender	.332	.203	.174	1.634	.106
	Ownership	-.549	.264	-.220	-2.079	.041

R^2 = 0,132

$R^{2'}$ = 0,099

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RESULTS & DISCUSSION: APPREHENSION

- H1: living in high risk area → ~~higher levels of perceived risk~~
  → **lower** levels of perceived risk

- "Optimism bias": the erroneous belief that others are more likely to be affected by the same risk (Weinstein, 1989)

Model		Unstandardized Coefficients		Standardized Coefficients		
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RESULTS & DISCUSSION: APPREHENSION

- H2: ~~higher age,~~ **female gender**, home ownership, ~~permanent residence & high education~~ → ~~higher levels of perceived risk~~ → **lower** levels of perceived risk

- Interpretation: men are more likely to be confronted with the risk associated with the responsibility of protecting the summer house in case of an emergency

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.529	.279		1.897	.062
	Risk area	-.522	.200	-.278	-2.615	.011
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	Ownership	-.549	.264	-.220	-2.079	.041

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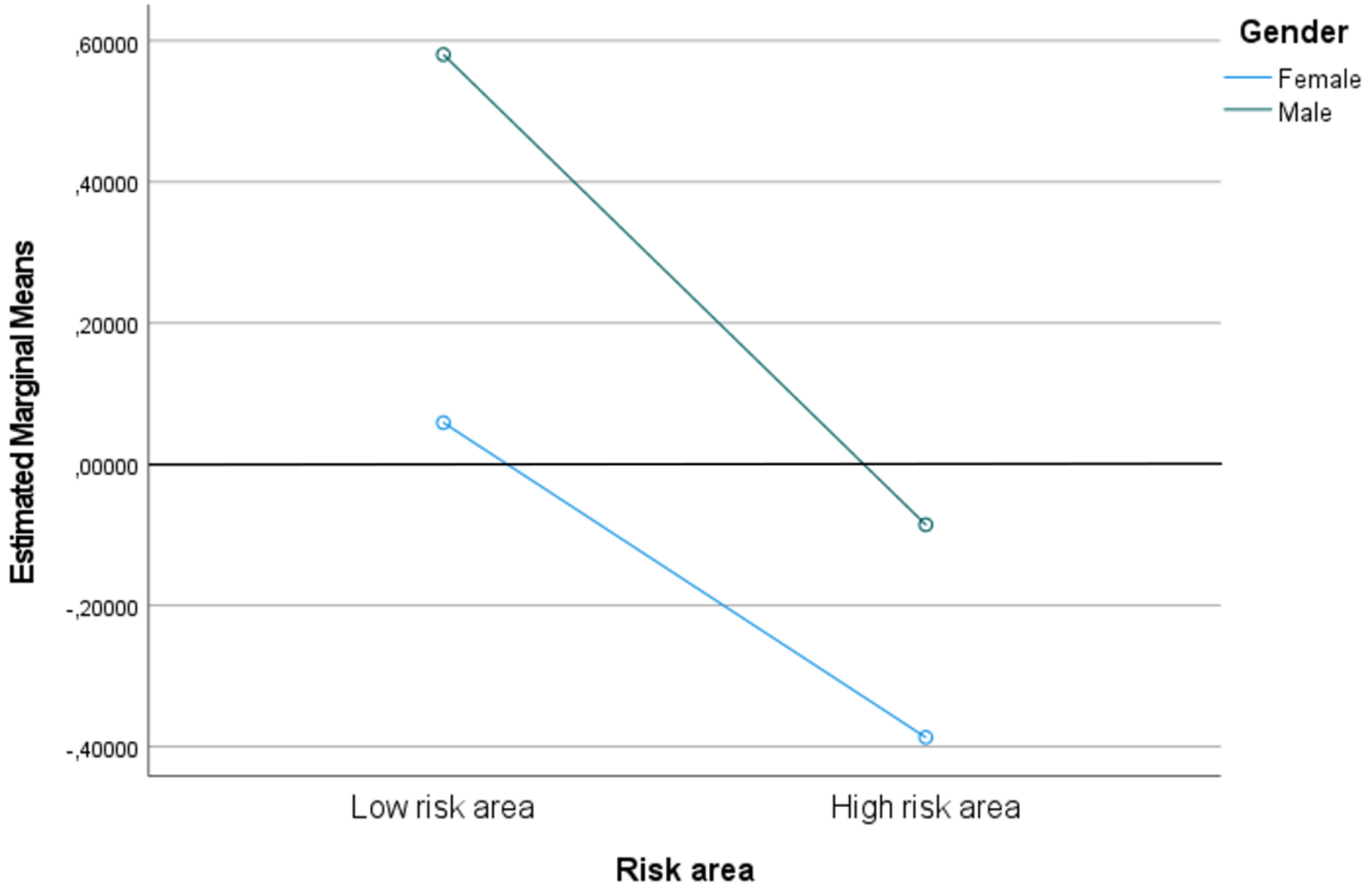
RESULTS & DISCUSSION: APPREHENSION

- Combining the findings of H1 and H2: difference in risk perception among areas is slightly more pronounced for men



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RESULTS & DISCUSSION: APPREHENSION

- H2: ~~higher age,~~ female gender, **home ownership**, ~~permanent residence & high education~~

~~→ higher levels of perceived risk~~

→ **lower** levels of perceived risk

Model		Unstandardized Coefficients		Standardized Coefficients		
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	Gender	.332	.203	.174	1.634	.106
	Ownership	-.549	.264	-.220	-2.079	.041

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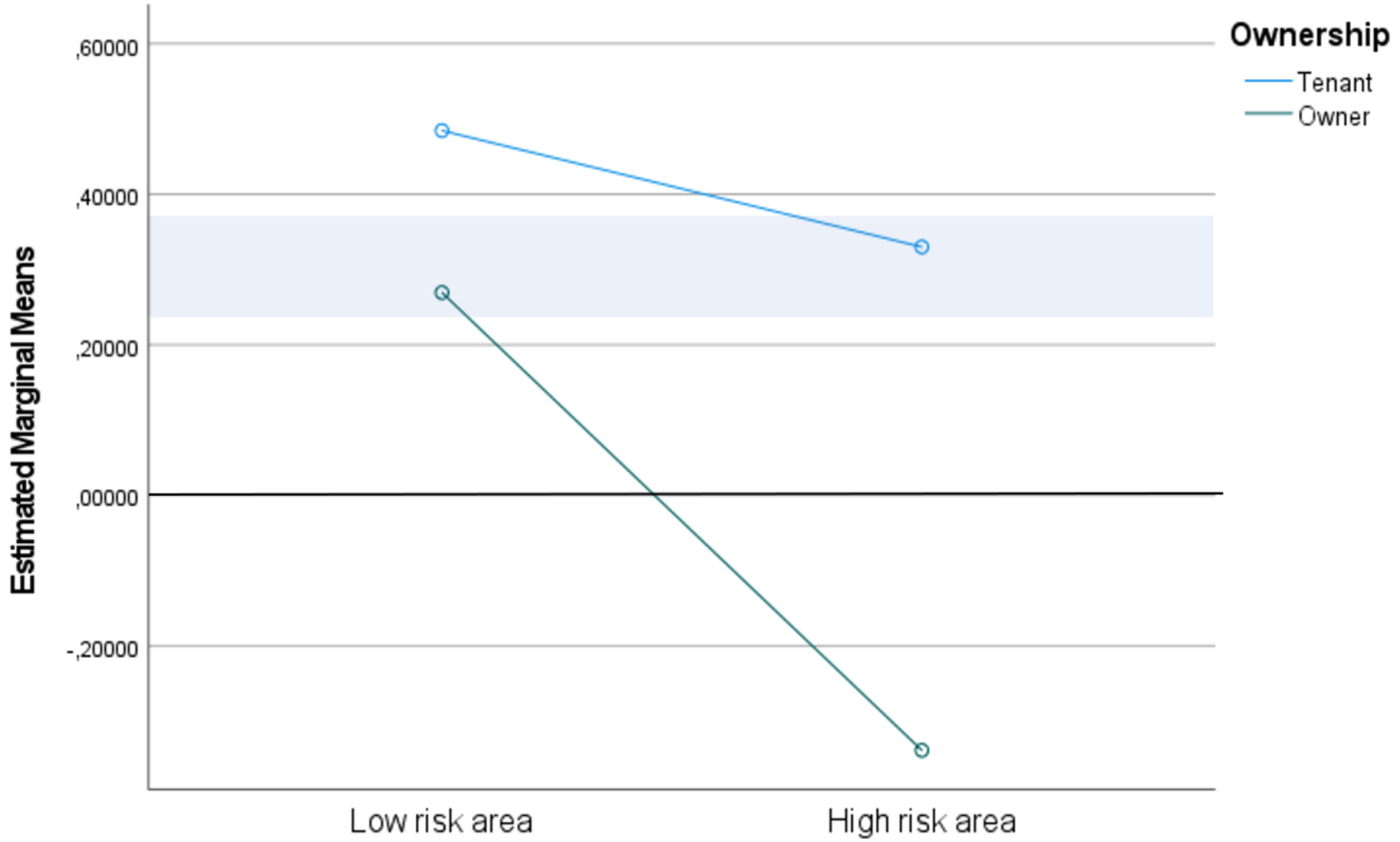
RESULTS & DISCUSSION: APPREHENSION

- Combining the findings of H1 and H2: difference in risk perception among areas is less pronounced for tenants
- Interpretation: since renting is temporary, risk perception doesn't influence their rental location as much



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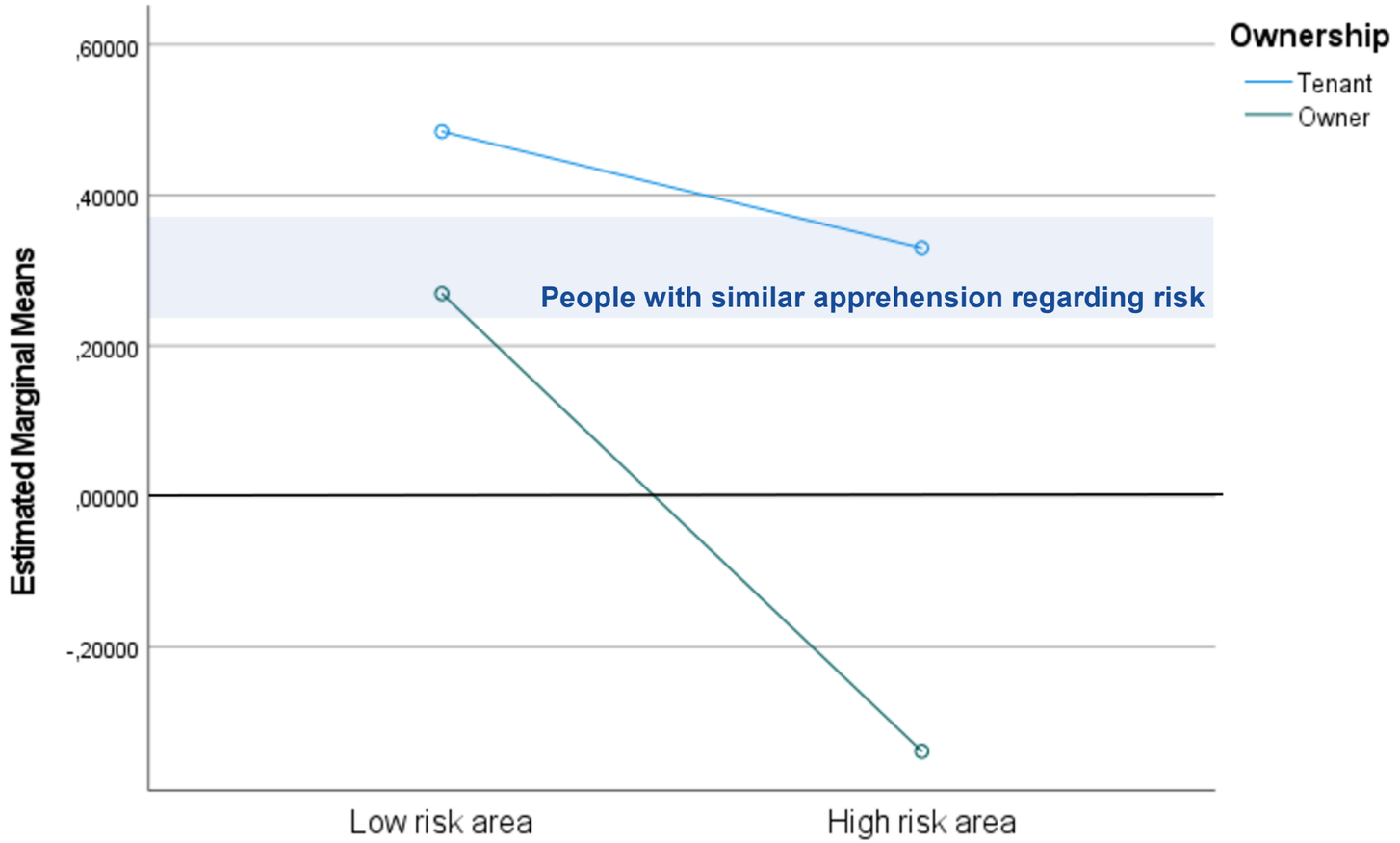
RESULTS & DISCUSSION: APPREHENSION

- Combining the findings of H1 and H2: people with similar apprehension regarding risk would rent in a high risk area, but buy property in a low risk area



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RESULTS & DISCUSSION: AWARENESS

- Risk perception < apprehension & **awareness**
- H3: previous flood experience → higher levels of perceived risk
- “Availability heuristic”: people who have previously experienced an important event can recall it more readily and are more aware of the magnitude of the consequences of that event (Tversky & Kahneman, 1974)

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.116	.099		-1.168	.246
	Flood experience	.396	.184	.235	2.160	.034

R^2 = 0,055

$R^{2'}$ = 0,043

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RESULTS & DISCUSSION: ADAPTATION MEASURES

- Larger >> Smaller adaptations
- Local ecosystem & accessibility beach → important

⟹ Soft structural solutions (e.g. wetlands)

- 13 people already take measures themselves
  → 11 live in high risk area
  → Also to protect against rainfall

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RESULTS & DISCUSSION: LIMITATIONS

- Question 15 → Too complex

  “I am prepared to pay for larger adaptation structures against flooding in the municipality, even if not every citizen is willing to”

- Question 19 → Overlap with 13 & 14

  “I prefer to pay for flooding adaptation on my own rather than paying extra taxes to the municipality to protect the community against flooding?”

- The answers of questions 8-13 & 15-18 → Subjective

Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
o	o	o	o	o

- High resolution of flood maps → Unnecessary

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CONCLUSION

- Flood risk increases every year
- Low risk → High apprehension (and vice versa)
- Men → better apprehension

⟹ Influence peoples emotional and personal components to change their behaviour

- Other risks for future research (e.g. heavy rain)

→ This methodology could be usefull!

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