

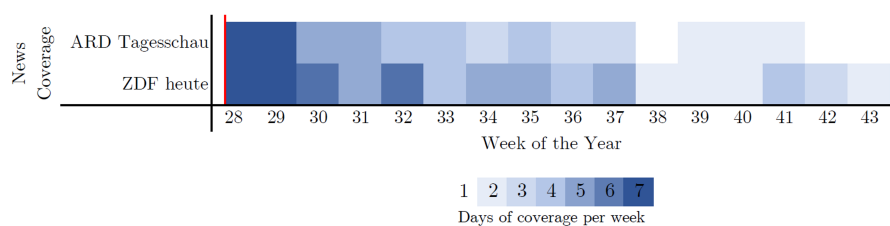
Supplementary Material for Adjusting to the New Normal: River Flood Risk and the Real Estate Market

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Descriptives

Descriptives: Salience of the 2021 Western European flood

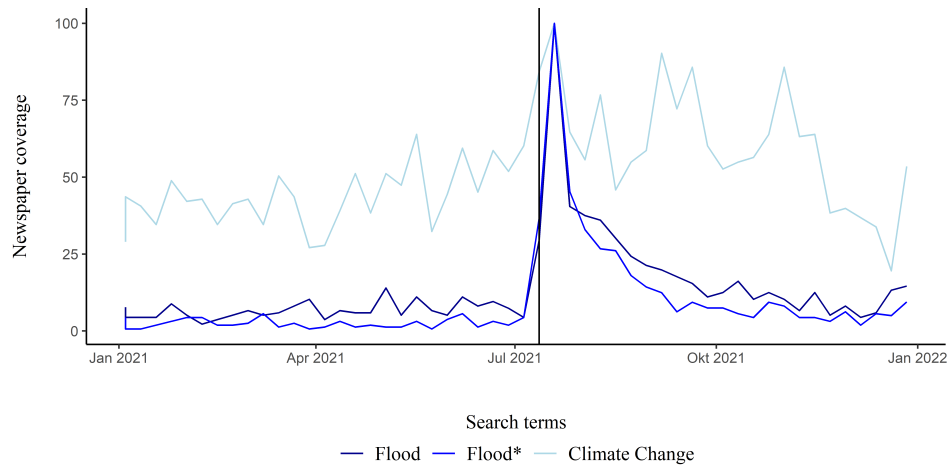
Figure A.1: Coverage of flood in key evening news



Notes: This figure depicts the number of days per week, the flood was mentioned in the evening news of ARD (*Tagesschau*) and ZDF (*heute*). These news formats are the most viewed in all of Germany, respectively reaching 11.8m and 4.6m viewers in 2020 (Zubayr et al., 2020).

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Figure A.2: Coverage of flood and climate change in leading nationwide newspapers in 2021

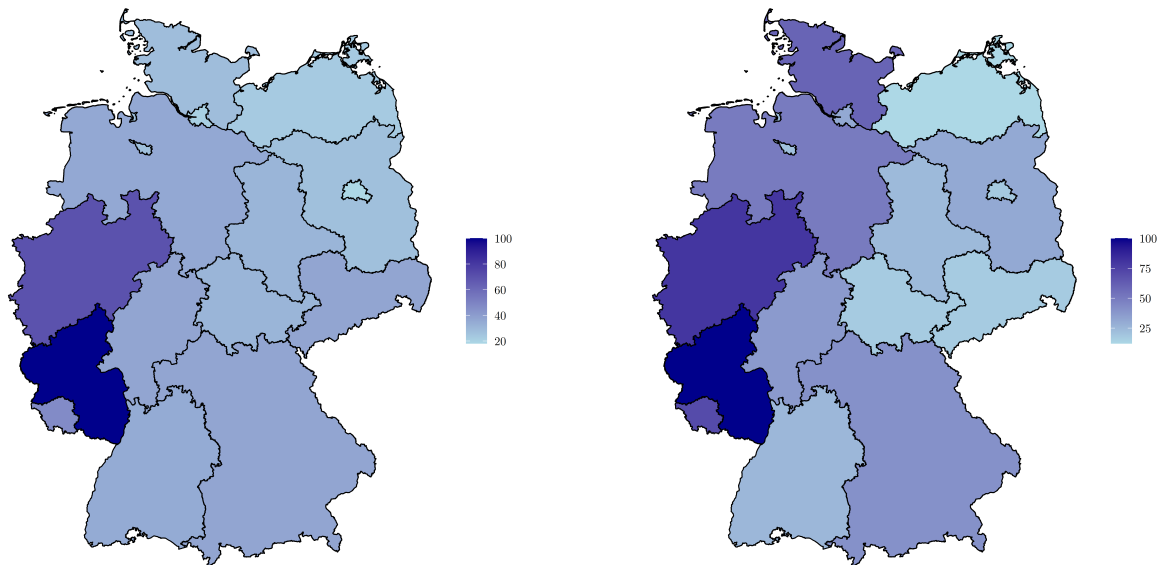


Notes: This figure depicts the weekly number of articles in the six highest circulating nationwide daily newspapers in Germany (Bild, SZ, FAZ, Handelsblatt, Die Welt, taz) mentioning the keywords "Flut"/"Hochwasser" (flood/flood*) and "Klimawandel" (climate change).

Figure A.3: Internet search activity across Germany

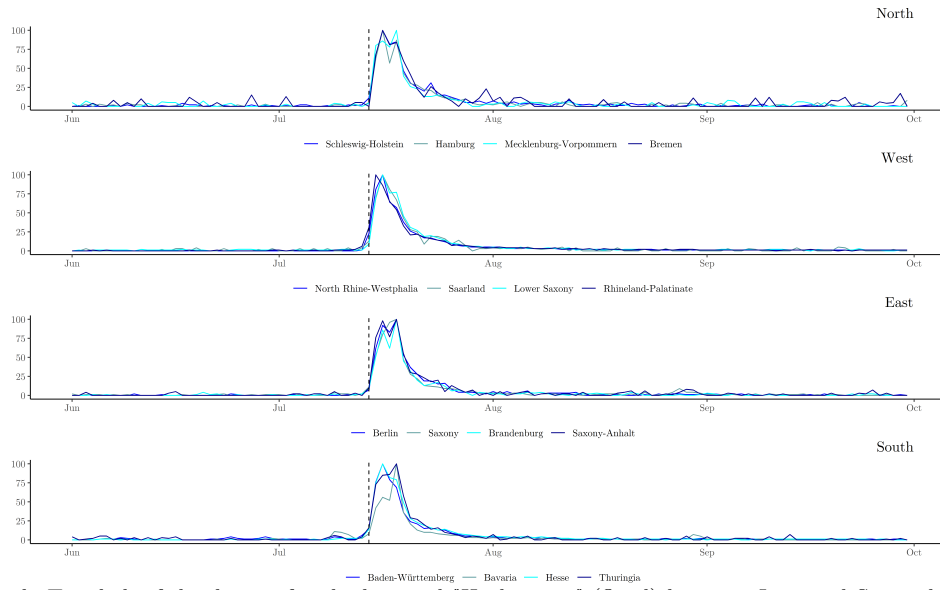
(a) "Flood"

(b) "Elementary damage insurance"



Notes: This figure depicts the regional Google Trends for the keywords "Hochwasser" (flood) and "Elementarversicherung" (elementary damage insurance) from June to September 2021.

Figure A.4: Regional internet search activity



Notes: Google Trends by federal state for the keyword "Hochwasser" (flood) between June and September 2021. We standardize the values, i.e. the highest value for the search term in each federal state within the period receives a value of 100.

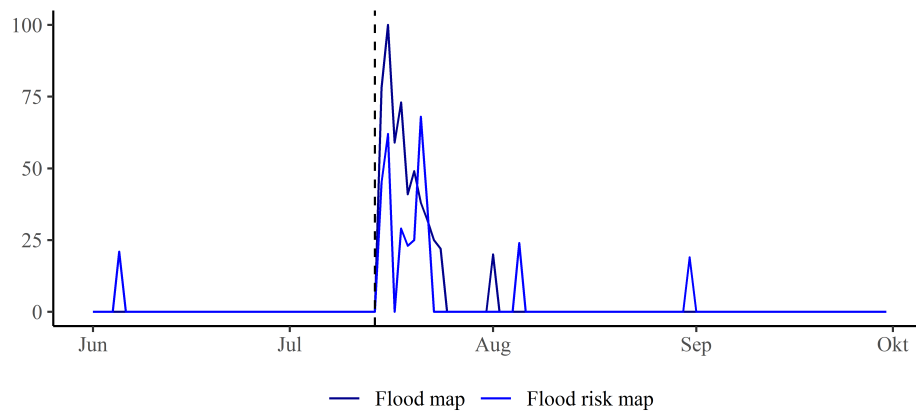
Descriptives: Salience of federal flood risk maps

Table A.1: Baseline (pre-treatment) flood risk valuation in Germany

	<i>Dependent variable: log (price per m²)</i>				
	(1)	(2)	(3)	(4)	(5)
Inside flood risk zone (dummy)	-0.0353*** (0.0059)	-0.0354*** (0.0059)	-0.0352*** (0.0069)	-0.0757*** (0.0132)	-0.0356*** (0.0059)
Property characteristics	✓	✓	✓	✓	✓
County×year linear trends					✓
Year fixed effects	✓	✓	✓	✓	✓
Month fixed effects	✓	✓	✓	✓	✓
Year-Month fixed effects	✓		✓	✓	✓
Zipcode fixed effects	✓	✓			✓
County fixed effects			✓		
1km ² fixed effects				✓	
Number of observations	1,338,629	1,338,629	1,340,537	1,329,504	1,338,629

Notes: This table presents the association of a house being located inside a flood risk zone with its price before the flood in July 2021. Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. Standard errors are clustered at the zip code level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

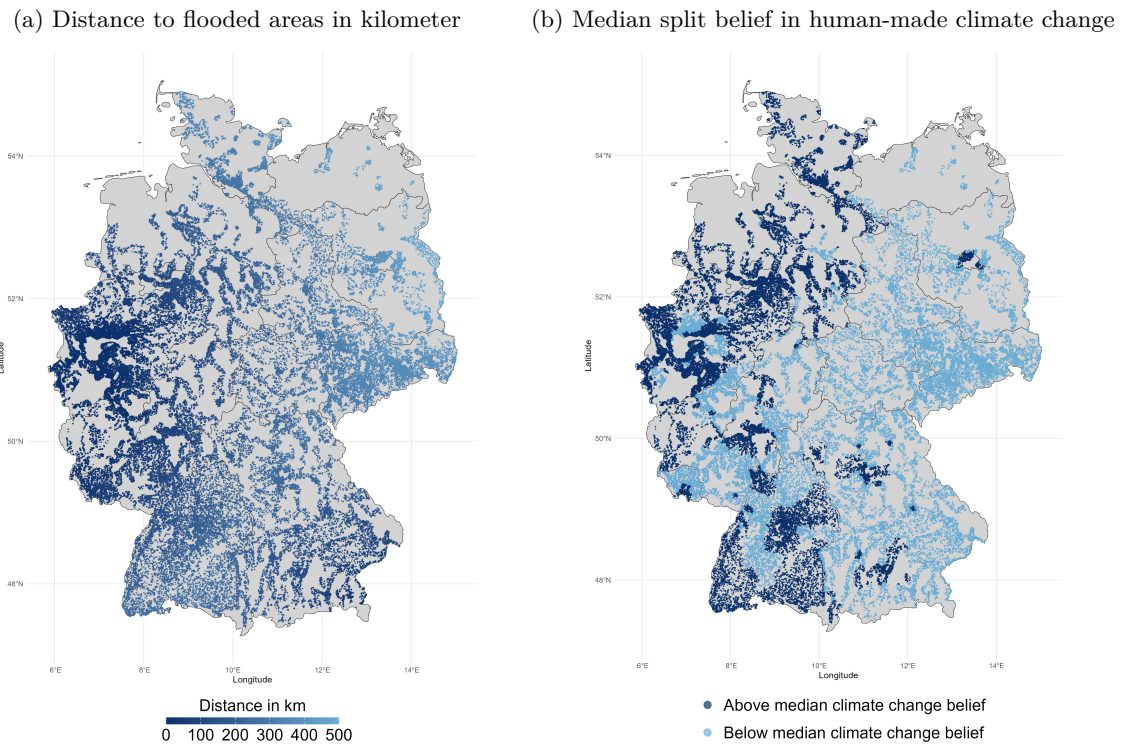
Figure A.5: Internet search activity



Notes: Relative Google Trends for the keywords "Hochwasserkarte" (flood map) and "Hochwassergefahrenkarte" (flood risk map) June to September 2021.

Descriptives: Heterogeneity variables

Figure A.6: Descriptives of heterogeneity variables

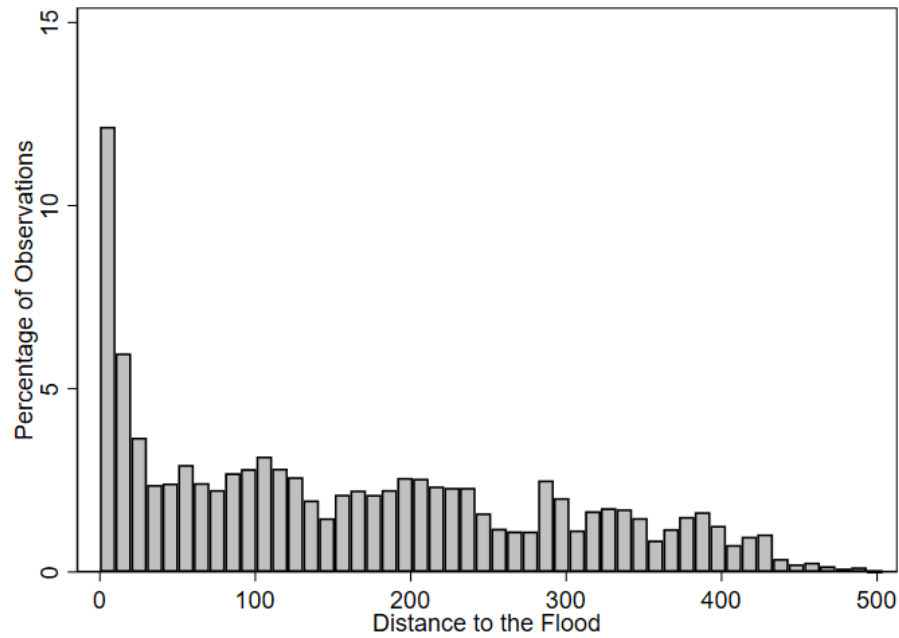


Notes: Panel a) displays the distance of our main sample properties to the flooded regions in kilometer. Panel b) displays the properties within districts with above of below median human-made climate change beliefs. The correlation of the two measures is 0.25.

Additional analyses

Heterogeneous effect: Additional analyses of the distance to the flooded area

Figure B.1: Histogram of the distance to the flooded area



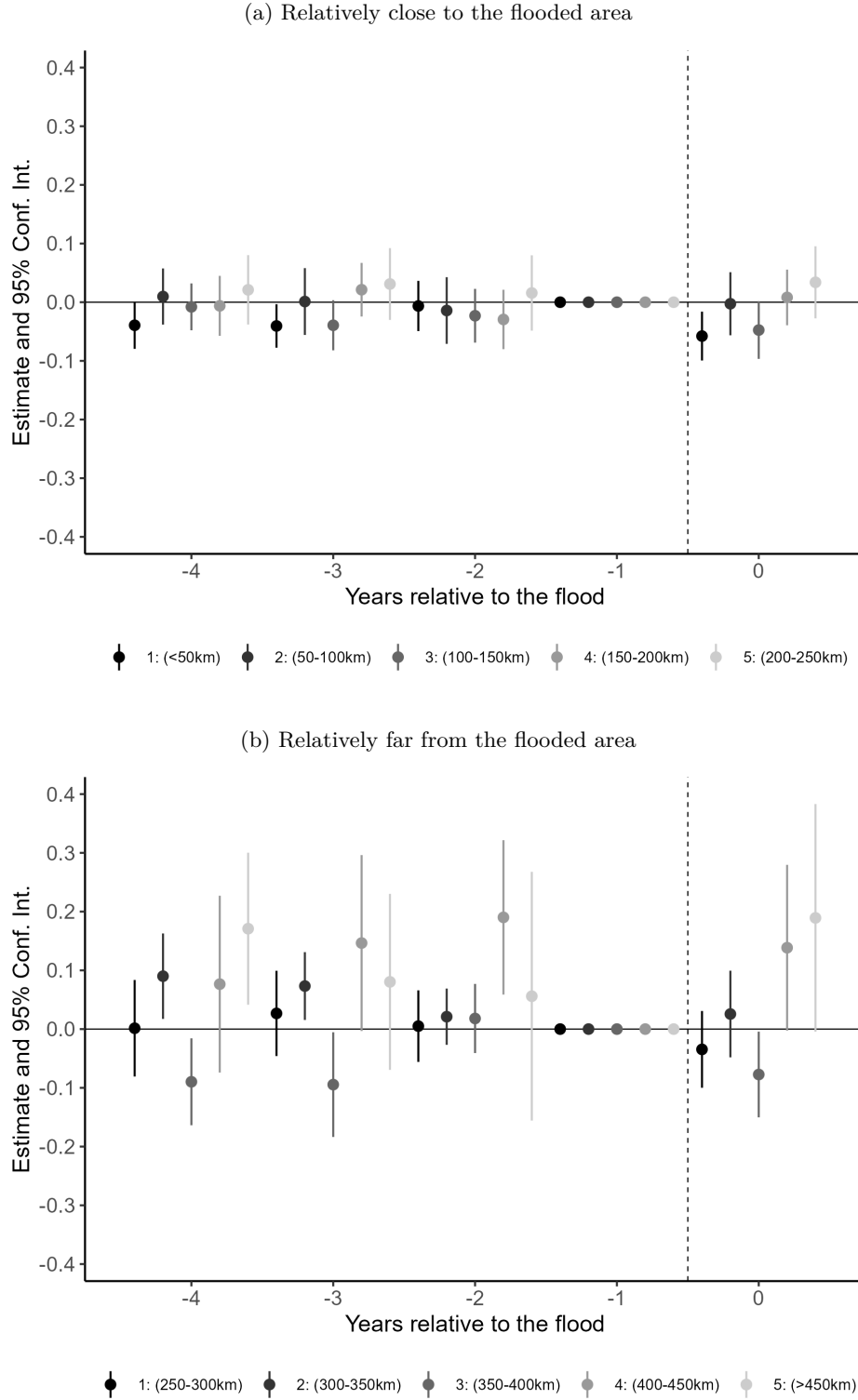
Notes: Histogram of the distance to the 2021 flood for the estimation sample.

Table B.1: Heterogeneous effect: Distance to flooded area (median interaction)

<i>Dependent variable: log (price per m²)</i>					
	(1)	(2)	(3)	(4)	(5)
Treatment effect	-0.0351** (0.0137)	-0.0351** (0.0137)	-0.0223 (0.0148)	-0.0243** (0.0106)	-0.0358*** (0.0137)
Treatment effect $\times$ above median distance	0.0607*** (0.0176)	0.0606*** (0.0176)	0.0498*** (0.0185)	0.0379** (0.0148)	0.0571*** (0.0182)
Treatment group dummy	✓	✓	✓	✓	✓
Post-treatment dummy	✓	✓	✓	✓	✓
Above median distance dummy	✓	✓	✓	✓	✓
Property characteristics	✓	✓	✓	✓	✓
County $\times$ year linear trends					✓
Year fixed effects	✓	✓	✓	✓	✓
Month fixed effects	✓	✓	✓	✓	✓
Year-Month fixed effects	✓		✓	✓	✓
Zipcode fixed effects	✓	✓			✓
County fixed effects			✓		
1km ² fixed effects				✓	
Number of observations	1,466,509	1,466,509	1,468,567	1,457,476	1,466,509

Notes: This table presents heterogeneous effects of the flood with respect to the distance of a house to the nearest potentially flooded area. Compared to Table 3, this table uses an interaction not with the continuous distance, but with an indicator for houses with distances above the median. Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. Standard errors are clustered at the zip code level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure B.2: Event studies: Distance bins



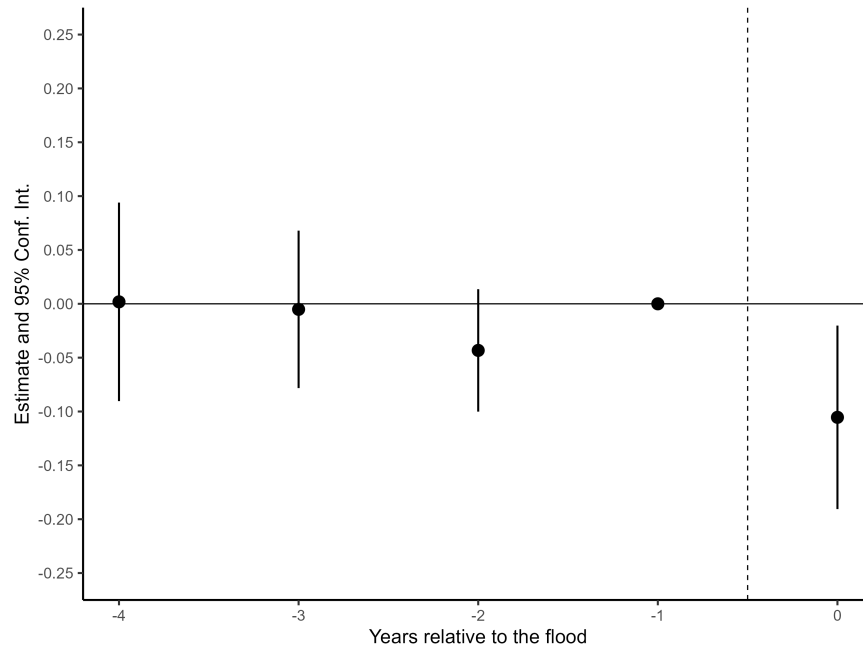
Notes: This figure presents eventstudy coefficients and 95% confidence intervals using Equation 2 and specification five in Table 3 and estimating the effects for mutually exclusive distance bands around the flood.

Table B.2: Robustness: Excluding regions that are more than 400 kilometers away from the flood

<i>Dependent variable: log (price per m²)</i>					
	(1)	(2)	(3)	(4)	(5)
Treatment effect	-0.0482*** (0.0169)	-0.0481*** (0.0170)	-0.0380** (0.0181)	-0.0359*** (0.0130)	-0.0482*** (0.0170)
Treatment effect $\times$ distance to flooded area (km)	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0002*** (0.0001)	0.0003*** (0.0001)
Treatment group dummy	✓	✓	✓	✓	✓
Post-treatment dummy	✓	✓	✓	✓	✓
Distance to the flood	✓	✓	✓	✓	✓
Property characteristics	✓	✓	✓	✓	✓
County $\times$ year linear trends					✓
Year fixed effects	✓	✓	✓	✓	✓
Month fixed effects	✓	✓	✓	✓	✓
Year-Month fixed effects	✓		✓	✓	✓
Zipcode fixed effects	✓	✓			✓
County fixed effects			✓		
1km ² fixed effects				✓	
Number of observations	1,406,073	1,406,073	1,406,710	1,396,158	1,406,073

Notes: This table presents heterogeneous effects of the flood with respect to the distance of a house to the nearest potentially flooded area. Compared to Table 3, this table excludes observations that are more than 400 kilometers away from the flood due to concerns about the parallel trends assumption in these regions (Figure B.2). Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. Standard errors are clustered at the zip code level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure B.3: Event studies: Treated houses near vs. far from the flood



Notes: This figure presents eventstudy coefficients and 95% confidence intervals comparing houses in flood risk areas in the nearest 150 kilometers to the flood with houses in flood risk areas in the farthest 150 kilometers. The approach is related to the strong parallel trends idea by Callaway et al. (2024) when assuming that the treatment effect of the flood reflects a continuous treatment over distance. The estimation uses Equation 2 and specification five in Table 2.

Regional trends

Table B.3: Regional trends

<i>Dependent variable: log (price per m²)</i>				
	(1)	(2)	(3)	(4)
B: Average results				
Treatment effect	-0.0071 (0.0100)	-0.0048 (0.0097)	-0.0107 (0.0095)	-0.0064 (0.0092)
B: Distance heterogeneity				
Treatment effect	-0.0585*** (0.0166)	-0.0515*** (0.0170)	-0.0406** (0.0165)	-0.0317** (0.0162)
Treatment effect × distance to flooded area (km)	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0002** (0.0001)	0.0001* (0.0001)
C: Climate change belief heterogeneity				
Treatment effect	0.0088 (0.0129)	0.0115 (0.0127)	-0.0057 (0.0116)	-0.0031 (0.0113)
Treatment effect × high climate change beliefs	-0.0377** (0.0180)	-0.0386** (0.0175)	-0.0119 (0.0179)	-0.0079 (0.0174)
County×year linear trends	✓	✓	✓	
County×year quadratic trends		✓	✓	
County×year cubic trends			✓	
County×year fixed effects				✓
Treatment group dummy	✓	✓	✓	✓
Post-treatment dummy	✓	✓	✓	✓
Non-interacted heterogeneity variable	✓	✓	✓	✓
Property characteristics	✓	✓	✓	✓
Year-Month fixed effects	✓	✓	✓	✓
Zipcode fixed effects	✓	✓	✓	✓
Number of observations	1,466,509	1,466,509	1,466,509	1,466,509

Notes: This table presents the results when including different county-specific time trends or fixed effects. Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. Standard errors are clustered at the zip code level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Repeat-listings approach

Table B.4: Repeat-listings approach

<i>Dependent variable: log (price per m²)</i>			
	(1)	(2)	(3)
B: Average results			
Treatment effect	-0.0083 (0.0072)	-0.0069 (0.0075)	-0.0087 (0.0070)
B: Distance heterogeneity			
Treatment effect	-0.0258** (0.0108)	-0.0336*** (0.0117)	-0.0258** (0.0107)
Treatment effect × distance to flooded area (km)	0.0001* (0.0001)	0.0002** (0.0001)	0.0001* (0.0001)
C: Climate change belief heterogeneity			
Treatment effect	-0.0070 (0.0101)	-0.0020 (0.0104)	-0.0103 (0.0097)
Treatment effect × high climate change beliefs	-0.0034 (0.0129)	-0.0114 (0.0136)	0.0022 (0.0117)
Treatment group dummy	✓	✓	✓
Post-treatment dummy	✓	✓	✓
Non-interacted heterogeneity variable	✓	✓	✓
Property characteristics	✓	✓	✓
County×year linear trends			✓
Year fixed effects	✓	✓	✓
Month fixed effects	✓	✓	✓
Year-Month fixed effects	✓		✓
House fixed effects	✓	✓	✓
Number of observations	409,173	409,173	409,173

Notes: This table presents average and heterogeneous effects of the flood based on a data set with multiple separate listings of the same house. Compared to Tables 2 and 3, this table uses a different data set based only on properties that are listed in our study period at least twice. We exclude listings that are likely related to the same sale since we cannot assign a precise date. These listings have the same characteristics and are not more than six months apart from each other. Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. The regressions in Panel C are based on 401,810 observations since we do not have information on climate change belief for some counties. Standard errors are clustered at the property level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Analysis of the volume of listings

Table B.5: Effect on the volume of listings

<i>Dependent variable: log (number of new listings)</i>			
	(1)	(2)	(3)
B: Average results			
Treatment effect	-0.0166 (0.0407)	-0.0156 (0.0402)	-0.0151 (0.0407)
B: Distance heterogeneity			
Treatment effect	-0.0697 (0.0654)	-0.0651 (0.0647)	-0.0672 (0.0653)
Treatment effect $\times$ distance to flooded area (km)	0.0004 (0.0004)	0.0004 (0.0004)	0.0004 (0.0004)
C: Climate change belief heterogeneity			
Treatment effect	-0.0529 (0.0626)	-0.0515 (0.0618)	-0.0536 (0.0625)
Treatment effect $\times$ high climate change beliefs	0.0714 (0.0784)	0.0708 (0.0776)	0.0761 (0.0784)
Treatment group dummy	✓	✓	✓
Post-treatment dummy	✓	✓	✓
Non-interacted heterogeneity variable	✓	✓	✓
County $\times$ year linear trends			✓
Year fixed effects	✓	✓	✓
Month fixed effects	✓	✓	✓
Year-Month fixed effects	✓		✓
Zip code fixed effects	✓	✓	✓
Number of observations	344,832	344,836	344,832

Notes: This table presents average and heterogeneous effects of the flood on the number of new listings. Compared to Tables 2 and 3, this table uses a different data set at the zip code and month level that counts the number of houses that are newly advertised. We assign the treatment group dummy to a zip code if part of the zip code is treated. For the distance measure, we take the median distance of houses in a zip code. Standard errors are clustered at the property level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Effects based on distance to the flood in regions with low belief in climate change

Table B.6: Effects based on distance to the flood in regions with low belief in climate change

<i>Dependent variable: log (price per m²)</i>					
	(1)	(2)	(3)	(4)	(5)
Treatment effect	-0.0882*** (0.0236)	-0.0883*** (0.0237)	-0.0566** (0.0265)	-0.0655*** (0.0200)	-0.0886*** (0.0237)
Treatment effect $\times$ distance to flooded area (km)	0.0004*** (0.0001)	0.0004*** (0.0001)	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0004*** (0.0001)
Treatment group dummy	✓	✓	✓	✓	✓
Post-treatment dummy	✓	✓	✓	✓	✓
Distance to the flood	✓	✓	✓	✓	✓
Property characteristics	✓	✓	✓	✓	✓
County $\times$ year linear trends					✓
Year fixed effects	✓	✓	✓	✓	✓
Month fixed effects	✓	✓	✓	✓	✓
Year-Month fixed effects	✓		✓	✓	✓
Zipcode fixed effects	✓	✓			✓
County fixed effects			✓		
1km ² fixed effects				✓	
Number of observations	732,705	732,705	733,131	726,647	732,705

Notes: This table presents heterogeneous effects of the flood with respect to the distance of a house to the nearest potentially flooded area only looking at regions with relatively low belief in climate change. Compared to Table 3, this table excludes regions with beliefs in climate change below the median. Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. Standard errors are clustered at the zip code level and shown in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Heterogeneous effects over time

Table B.7: Heterogeneous effect over time: Distance to flooded areas

<i>Dependent variable: log (price per m²)</i>					
	(1)	(2)	(3)	(4)	(5)
Treat×(0 to 2 mo)	-0.0675*** (0.0235)	-0.0931*** (0.0234)	-0.0527** (0.0263)	-0.0500*** (0.0164)	-0.0683*** (0.0236)
Treat×(3 to 5 mo)	-0.0529** (0.0236)	-0.0285 (0.0236)	-0.0233 (0.0257)	-0.0370** (0.0187)	-0.0492** (0.0238)
Treat×(6 to 8 mo)	-0.0377 (0.0256)	-0.0331 (0.0255)	-0.0112 (0.0270)	-0.0257 (0.0195)	-0.0372 (0.0255)
Treat×(9 to 10 mo)	-0.0876*** (0.0232)	-0.0943*** (0.0229)	-0.0681*** (0.0235)	-0.0610*** (0.0193)	-0.0880*** (0.0232)
Treat×(0 to 2 mo) × distance to flooded area	0.0004*** (0.0001)	0.0004*** (0.0001)	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0003*** (0.0001)
Treat×(3 to 5 mo) × distance to flooded area	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0002* (0.0001)	0.0002** (0.0001)	0.0002* (0.0001)
Treat×(6 to 8 mo) × distance to flooded area	0.0002* (0.0001)	0.0002* (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.0002* (0.0001)
Treat×(9 to 10 mo) × distance to flooded area	0.0005*** (0.0001)	0.0005*** (0.0001)	0.0003*** (0.0001)	0.0003*** (0.0001)	0.0005*** (0.0001)
Treatment group dummy	✓	✓	✓	✓	✓
Post-treatment dummy	✓	✓	✓	✓	✓
Distance to flooded area	✓	✓	✓	✓	✓
Property characteristics	✓	✓	✓	✓	✓
County×year linear trends					✓
Year fixed effects	✓	✓	✓	✓	✓
Month fixed effects	✓	✓	✓	✓	✓
Year-Month fixed effects	✓		✓	✓	✓
Zipcode fixed effects	✓	✓			✓
County fixed effects			✓		
1km ² fixed effects				✓	
Number of observations	1,466,509	1,466,509	1,467,157	1,456,073	1,466,509

Notes: This table presents the temporal dynamics of the heterogeneous effects with respect to the distance of a house to the nearest potentially flooded area. The treatment effects are interacted with different post-treatment time frames (in parentheses). Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. Standard errors are clustered at the zip code level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.8: Heterogeneous effect over time: Climate change belief

	<i>Dependent variable: log (price per m²)</i>				
	(1)	(2)	(3)	(4)	(5)
Treat×(0 to 2 mo)	0.0171 (0.0160)	-0.0071 (0.0156)	0.0204 (0.0181)	0.0120 (0.0133)	0.0094 (0.0170)
Treat×(3 to 5 mo)	0.0090 (0.0141)	0.0337** (0.0140)	0.0245 (0.0158)	-0.0051 (0.0130)	-0.0007 (0.0161)
Treat×(6 to 8 mo)	0.0093 (0.0194)	0.0137 (0.0192)	0.0162 (0.0203)	-0.0033 (0.0168)	0.0089 (0.0194)
Treat×(9 to 10 mo)	0.0196 (0.0230)	0.0134 (0.0227)	0.0018 (0.0219)	0.0089 (0.0183)	0.0194 (0.0230)
Treat×(0 to 2 mo) × high climate change beliefs	-0.0523** (0.0259)	-0.0530** (0.0260)	-0.0406 (0.0289)	-0.0255 (0.0193)	-0.0467* (0.0260)
Treat×(3 to 5 mo) × high climate change beliefs	-0.0326 (0.0238)	-0.0329 (0.0239)	-0.0373 (0.0242)	-0.0093 (0.0200)	-0.0218 (0.0239)
Treat×(6 to 8 mo) × high climate change beliefs	-0.0301 (0.0272)	-0.0299 (0.0272)	-0.0218 (0.0280)	-0.0125 (0.0218)	-0.0291 (0.0273)
Treat×(9 to 10 mo) × high climate change beliefs	-0.0596** (0.0275)	-0.0602** (0.0275)	-0.0263 (0.0272)	-0.0449** (0.0225)	-0.0596** (0.0276)
Treatment group dummy	✓	✓	✓	✓	✓
Post-treatment dummy	✓	✓	✓	✓	✓
High climate change beliefs dummy	✓	✓	✓	✓	✓
Property characteristics	✓	✓	✓	✓	✓
County×year linear trends					✓
Year fixed effects	✓	✓	✓	✓	✓
Month fixed effects	✓	✓	✓	✓	✓
Year-Month fixed effects	✓		✓	✓	✓
Zipcode fixed effects	✓	✓			✓
County fixed effects			✓		
1km ² fixed effects				✓	
Number of observations	1,466,509	1,466,509	1,468,567	1,457,476	1,466,509

Notes: This table presents the temporal dynamics of the heterogeneous effects with respect to the county-level belief in climate change. The treatment effects are interacted with different post-treatment time frames (in parentheses). Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. Standard errors are clustered at the zip code level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Heterogeneous effects: Socioeconomic characteristics and risk level

Table B.9: Heterogeneous effects: Socioeconomic characteristics and risk level

<i>Dependent variable: log (price per m²)</i>				
	Purchasing power	Building density	Unemployment	Flood risk level
	(1)	(2)	(3)	(4)
Treatment effect	0.0399 (0.0679)	0.0066 (0.0177)	-0.0090 (0.0164)	0.0078 (0.0139)
Treatment effect $\times$ 1km ² purchasing power per capita	-0.0022 (0.0030)			
Treatment effect $\times$ 1km ² number of buildings (10)		-0.0003 (0.0002)		
Treatment effect $\times$ 1km ² share of unemployment			0.0002 (0.0023)	
Treatment effect $\times$ Medium flood risk level				-0.0294 (0.0185)
Treatment effect $\times$ High flood risk level				-0.0357 (0.0350)
Treatment group dummy	✓	✓	✓	✓
Post-treatment dummy	✓	✓	✓	✓
Non-interacted heterogeneity variable	✓	✓	✓	✓
Property characteristics	✓	✓	✓	✓
County $\times$ year linear trends	✓	✓	✓	✓
Year-Month fixed effects	✓	✓	✓	✓
Zipcode fixed effects	✓	✓	✓	✓
Number of observations	1,461,966	1,462,189	1,461,966	1,466,509

Notes: This table presents heterogeneous effects of the flood with respect to the 1km² purchasing power per capita and the risk level of a flood risk zone. Data on purchasing power, the number of inhabitants, the number of buildings, and unemployment share comes from the RWI-GEO-GRID data set (Breidenbach & Eilers, 2018). Property characteristics include the construction year of the house (categorical), the size of the living space, the number of floors, the number of rooms, the presence of a cellar, and the conditions of the structure. Standard errors are clustered at the zip code level and shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.