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* Views expressed are those of the author and do not necessarily reflect official positions of De Nederlandsche Bank.

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Abstract

We study homeowners' financial resilience in the face of flood risk. Using three subsequent surveys among Dutch households, we compare owners of at-risk properties to a control sample of owners living outside a potential flood zone. While the former start exhibiting greater awareness of flood risk, this awareness is not specifically reflected in financial resilience. First, we find no significant differences in terms of net financial wealth or savings. Second, the mortgages that finance the properties have comparable loan-to-value ratios, both at origination and over time. The findings on resilience may reflect a high degree of trust in flood protection. The absence of insurance coverage combined with expected *ex post* government support may also be a factor.

JEL codes: Q54, Q56, D14
Keywords: homeownership, insurance protection gaps, protection motivation theory, financial resilience

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1 Introduction

There is increasing attention for the possible transmission of climate-related physical shocks, such as storms, floods, and wildfires, to financial stability. Mark Carney (2015) was among the first to argue that property damage caused by extreme weather events could threaten financial stability. Similar arguments have been made by the European Systemic Risk Board (2016), Bolton et al. (2020), and the Financial Stability Board (2025).

The impact of extreme weather events on financial stability depends on various factors, including on households' financial resilience (FSB, 2025). The latter is, in particular, material when climate-related physical risks coincide with financial vulnerabilities within the household sector. Caloia et al. (2023), for instance, show that floods are more likely to increase credit risk for Dutch banks when starting point loan-to-value (LTV) ratios for mortgages in their loan book are already elevated. Comparable studies have been conducted by financial authorities in Australia (Bellrose et al., 2021), Canada (Johnston et al., 2023), and Spain (AMCESFI, 2023).[1]

Given their potential role in transmitting climate shocks, it is important that households are financially resilient. This presupposes two key factors: first, that households are aware of these risks; and second, that this awareness leads to prudent financial decisions. As a general framework, this paper uses Protection Motivation Theory (Rogers, 1975; Rogers, 1983). Protection Motivation Theory (PMT) indicates that a person's likelihood to act in the face of risk depends on two factors: threat appraisal and coping appraisal. Awareness relates to threat appraisal. If a person is more aware of flood risk, this will be reflected in how the individual perceives this threat. Prudent financial decisions would be the outcome of the process, i.e. the extent to which an individual has acted to mitigate risk. Coping appraisal is related to how an individual sees her ability to deal with the potential risk.

[1] See also Peters (2024) or Reijnders et al. (2025) for discussions of the impacts of climate shocks on the banking system.

Regarding awareness, there is prior evidence that homeowners have difficulty in assessing climate-related risks. Botzen et al. (2013) report that for a sample of New York residents only a minority have accurate perceptions of their flood probability, damage and risk. Likewise, Mol et al. (2020) find that Dutch residents overestimate the probability of floods and underestimate the maximum expected flood depth.

Regarding household decision-making, much of the literature has taken the perspective of adaptation. A survey by Hornsey et al. (2016) finds that climate change beliefs have only moderate effects on people's willingness to act. Nauges and Wheeler (2017) find that economic incentives can at least partly affect decisions of non-environmentally-motivated households. Noll, Filatova, and Need (2022) find that both prior adaptations and intended future adaptations have a positive effect on the willingness to undertake a specific adaptation measure. In related work, however, Noll et al. (2022) report that perceived flood probability and damage have nearly no effect on motivating households' adaptation actions. Endendijk et al. (2023) do find evidence that timely warnings before flooding can help households in taking emergency actions like placing sandbags.

This paper contributes to the literature by putting financial resilience central. In contrast to the extensive evidence on household adaptation, financial resilience has received comparatively less attention.[2] A particularly relevant factor in the Dutch context is that insurance policies almost always exclude damages from major floods.[3] Hence, as a Dutch homeowner, a direct route to ensuring financial resilience via taking out insurance is not available. In terms of PMT, an alternative route to cope with the risk should then be considered. Therefore, this paper focuses on more general notions

[2]Ilhan (2022) finds that U.S. households at risk from sea level rise participate less in the stock market. The interpretation in that paper focuses more on uninsurable background risk rather than financial resilience, however.

[3]Specifically, these would be floods due to breaches in primary flood protection systems, which protect against floods from seas and main rivers.

of financial resilience, namely household wealth, savings, and LTV ratios.[4]

In terms of methodology, we use three waves of detailed survey data among Dutch households. This survey was conducted via the Centerpanel, which is affiliated to the University of Tilburg. Given our focus on the Dutch context, we focus on flood risk specifically. Nearly a quarter of the Dutch landmass lies below sea level, and about 80% of the population lives in areas at risk of flooding, making flood risks one of the most prominent climate-related threats in the Netherlands.[5] As part of the surveys, we asked respondents to indicate which climate-related hazard would be the main threat to their property. At the same time, the data set has information on whether the respondent lives in a flood zone or not. Using this data set, our first test is whether owners of properties at risk of flooding are more likely to report floods as the number one threat—compared to a control group of owners that do not live in an at-risk area. A second series of tests analyses the financial resilience of households. We utilise detailed information available within the Centerpanel, including comprehensive background data on households' assets and liabilities, to construct a measure of net household wealth. We also use information on savings, as a relatively liquid component of household wealth. Additionally, we combine information on the mortgages that finance a property with property value assessments to calculate LTV ratios.

Turning to the results, we do find evidence that at-risk owners are more aware of flood risk. In particular, at-risk homeowners are 9 percentage points more likely to report flood as the main threat to their property.[6] However, there are no indications that such awareness is matched by greater financial

[4]See also Wiersma et al. (2025) for a survey-based approach to measuring financial resilience.

[5]See also https://themasites.pbl.nl/o/flood-risks/ URL last accessed on 28 January 2025.

[6]This result is in line with Jansen (2024), who analysed two of the three waves analysed in this paper.

resilience compared to the control group. First, we find no significant differences in terms of financial wealth between owners of at-risk properties and owners in the control group. There are also no differences in the more liquid components of wealth, such as savings. Second, the mortgages that finance the properties of at-risk owners have comparable LTV ratios to those of the control group, both at origination and over time.

Together, the apparent disconnect between awareness and resilience suggests a potential financial vulnerability, in particular if climate change would result in more frequent and impactful flood events. For the moment, our findings on financial resilience may well reflect a high degree of public trust in flood protection. The unavailability of insurance coverage in combination with expected *ex post* government support could also be a factor. We discuss these factors in more detail in the concluding Section 4. Before that, Section 2 discusses the research design, while Section 3 present the results.

2 Data and methods

We use three survey waves that were collected among the members of the Centerpanel. Centerdata, a research centre affiliated to the University of Tilburg, has been operating the DNB Household Survey on an annual basis since 1993. All panel members aged 16 and above were eligible to complete the questionnaire. The core survey gathers detailed demographic and economic characteristics from a sample of Dutch households. Besides the core survey, we use responses to a set of additional questions that were first asked in the spring of 2021. These additional questions were again submitted to panel participants in the spring of 2023 and 2024. The first two waves were previously analysed by Jansen (2024), who identified a disconnect between flood awareness and intentions to undertake climate mitigation measures by improving energy efficiency of their property. The appendix lists two relevant questions as they were presented to the panel members.

In general, survey data offers valuable insights by directly capturing individual perceptions, awareness, and other behavioural elements that are often difficult to observe through other means. An alternative to studying financial resilience would be the use of microdata.[7] However, such an approach would not enable us to study the link between awareness and resilience. Using microdata also would not allow us to control for prior experience with climate-related shocks. Therefore, for the purposes of our paper, using survey data has distinct advantages. Admittedly, using survey data may also have drawbacks. For instance, households may report certain information less accurately.

To study awareness, we use the same question as in Jansen (2024). Participants could indicate which risk they see as the largest threat to their current place of residence. We provided the survey participants with nine options. Most of these options relate to climate-related physical risks, such as extreme rain, high wind speeds, or floods. Even though there is no link with climate change, we also included earthquakes as an option, as various earthquakes have occurred in the northern part of the Netherlands in recent decades due to natural gas extraction.

In recent years, the Netherlands experienced two distinct flood events, which could impact the awareness of flood risk among respondents. The first survey wave was collected a few months before the floods in Limburg (and parts of Belgium and Germany) during the summer of 2021. During this event, around 2300 Dutch houses were damaged and the total costs of damage for the Netherlands are estimated to be €433 million.[8] Between the second and third survey wave, the Netherlands experienced high water and local riverine floods around Christmas 2023. Section 3 will discuss the effect of these two events on flood awareness.

To study financial resilience, we add information on household assets and

[7] See, for instance, Deelen et al. (2025).

[8] See https://publications.deltares.nl/11207700_007_0011.pdf

liabilities. Using information for the core Centerpanel dataset, we construct a measure for financial wealth as follows.[9] Total assets are constructed out of all financial assets - such as payment, savings, and investment accounts, shares, and life insurance policies - and other assets such as immovable properties and vehicles. Total debt consists of all loans including mortgages and student debt. Table A.1 in the appendix has further details on the construction of the wealth variable. The savings variable is a subset of the wealth variable. This variable is added to get a better picture of liquid buffers, which can more readily be used in case of flood damage. The savings variable consists of payment, savings and deposit accounts, savings passbooks and savings certificates and notes.

To measure the degree to which respondents are at risk, we use a binary dummy variable (*AtRisk*). Here, we use flood maps provided by the Dutch government and define *AtRisk* based on four-digit postal code areas. When *AtRisk* takes a value of zero, the respondent's property lies in a postal code that is not at risk from breaches in flood protection systems. A value of 1 indicates that, according to the flood map, the respondent owns a property that is at risk from flooding, in particular those for which no insurance coverage is available. Based on this approach, a majority of the survey respondents are from at-risk areas of the Netherlands.[10] This large share of at-risk owners is in line with priors: these at-risk areas are also the ones that are most densely-populated and where most of the economic activity takes place.[11]

Using the survey responses, we estimate various random effects panel regression models, where $T = 3$. We use an unbalanced panel with 5,142

[9]Other examples using the Centerpanel to study household wealth include Van Rooij et al. (2012) and Christelis et al. (2021).

[10]As in Jansen (2024), we do not use responses from at-risk owners living outside protected areas. For that sub-sample, we only have a small number of observations available.

[11]Data constraints limit us to an approach based on a binary classification using a list of four-digit postal code areas. Naturally, future work could try to improve in terms of geographic granularity.

observations for the awareness variables and between 1,703 and 4,354 observations for the resilience variables.[12] Given that the vast majority of respondents (≥ 95%) did not move houses between the survey dates, we use a random effects specification of the individual specific effects. The panel regressions have the following general form:

$$y_{it} = \beta_1 AtRisk_{it} + \boldsymbol{x}'_{it}\boldsymbol{\beta} + \omega_t + \alpha_i + \epsilon_{it} \quad (1)$$

where y_{it} is either flood risk awareness or a measure of financial resilience, i is an index for survey respondents, t indexes the three survey waves, ω_t is a fixed effect for the survey waves, α_i is individual-specific random effect, and ϵ_{it} is an error term. Regarding awareness, the dependent variable is a binary indicator for whether respondents see flood risk as the main threat to their property. Regarding financial resilience, we use four different metrics. First, household wealth (in logs), savings (in logs) or the LTV ratio (either at origination or based on the latest available property value). The variable *AtRisk* is a binary dummy that indicates whether a respondent's property is located in a flood risk area. As noted above, there is only a small share of respondents that move house in our sample. Hence, most of the variation in *AtRisk* is cross-sectional and we opt for a random-effects specification of α_i. The vector x has a range of covariates.

Table 1 gives a description of the main covariates. These covariates range from individual social and economic indicators such as income and education to covariates indicating former experience with natural hazards. The table also shows a comparison between the at-risk group and the control group. We find significant differences for the age categories 35–49 and 65+, with the former group more likely to be at risk and the latter less likely. Besides age, the income class 'low' and having a university degree show significant differences. According to official statistics, people living in potential flood zones are more likely to have a university degree.[13] Also, respondents living

[12]The conclusions remain comparable when using a balanced sample.

[13]https://www.cbs.nl/nl-nl/dossier/dossier-verstedelijking/

outside flood zones are more likely to have a low income.[14] These significant differences indicate the importance of including a range of socio-economics controls in the regression models. Lastly, we find no significant differences for the variables tracking prior experience. To some extent, this is surprising when it concerns the flood risk experience. Intuitively, one would expect the percentage of not-at-risk owners with prior damages to be lower. This suggests that these variables are measured with some imprecision, perhaps due to recall bias.

waar-wonen-mensen-met-een-hbo-of-universitair-diploma-. URL last accessed on 27 May 2025.

[14]https://www.vzinfo.nl/sociaaleconomische-gezondheidsverschillen/sociaaleconomische-verschillen/regionaal/inkomen. URL last accessed on 27 May 2025.

Table 1: Descriptives for covariates

	Owns a property that is:		
	Not at risk	*At risk*	
	(1)	(2)	(3)
Male	0.53	0.51	-0.02 [0.02]
Age			
- 16 to 34	0.08	0.08	0.01 [0.01]
- 35 to 49	0.23	0.26	0.04* [0.02]
- 50 to 64	0.31	0.32	0.01 [0.02]
- 65+	0.39	0.33	-0.05* [0.02]
Income			
- low	0.30	0.24	-0.05** [0.02]
- middle	0.20	0.20	0.01 [0.02]
- high	0.16	0.18	0.02 [0.02]
- n.a.	0.34	0.37	0.03 [0.02]
Has university degree	0.13	0.18	0.05** [0.02]
Socio-economic status			
- low	0.15	0.14	-0.01 [0.02]
- high	0.61	0.63	0.02 [0.02]
Prior experience			
- Earthquake	0.06	0.05	-0.01 [0.01]
- Wind damage	0.32	0.31	-0.01 [0.02]
- Flood	0.01	0.01	0.00 [0.00]
- Drought	0.22	0.19	-0.03 [0.02]
Trusts flood protection	0.86	0.85	-0.01 [0.02]
Number of owners	1,112	2,114	

Notes: Descriptives for socio-economic covariates. Column 1 focuses on a control group of owners, while column 2 focuses on owners of at-risk properties. Entries represent fractions of the total sample. Columns 3 indicates significant differences based on two-sided t tests (standard errors in brackets); $*p < 0.05$, $**p < 0.01$.

3 Results

Table 2 presents selected coefficients and standard errors (clustered at the household level, in brackets) for five models based on Equation 1. The dependent variables are: a binary dummy indicating whether the respondent sees flood as main risk to their property (column 1); household financial wealth (in logs, column 2); household savings (in logs, column 3); and, the LTV ratio of the mortgage, either at origination of the loan (column 4) or most recent (column 5). The main explanatory variable indicates whether the respondent owns an at-risk property. The covariates include various owner characteristics and prior experience with property damage due to natural hazards.

Regarding awareness of flood risk, column 1 shows that owning a property in a flood zone significantly increases the likelihood of perceiving flooding as the primary threat. The estimated difference between at-risk owners and the control group is 9 percentage points. This estimated difference is comparable, though slightly lower, than that reported in Jansen (2024) for the 2021 and 2023 survey waves. In terms of composition, for the at-risk owners, 12.1% report that they perceive flooding as the primary threat to their home. In contrast, only 3.5% of respondents in the control group mention flooding as the main risk to their house. An elevated awareness of flood risk aligns with expectations, as property owners typically bear the financial burden of flood-related damages, reinforcing the importance of risk perception in these areas.

In addition, prior experience with flooding plays a crucial role in shaping homeowners' risk perception. This is in line with the literature on PMT (e.g., Bubeck et al., 2012). Those who have experienced a flood event in the past are 16 percentage points more likely to identify flooding as the main threat to their property. Also, we find that homeowners who have experienced damage due to an earthquake are 8 percentage points less likely to perceive flooding as the main threat to their property.

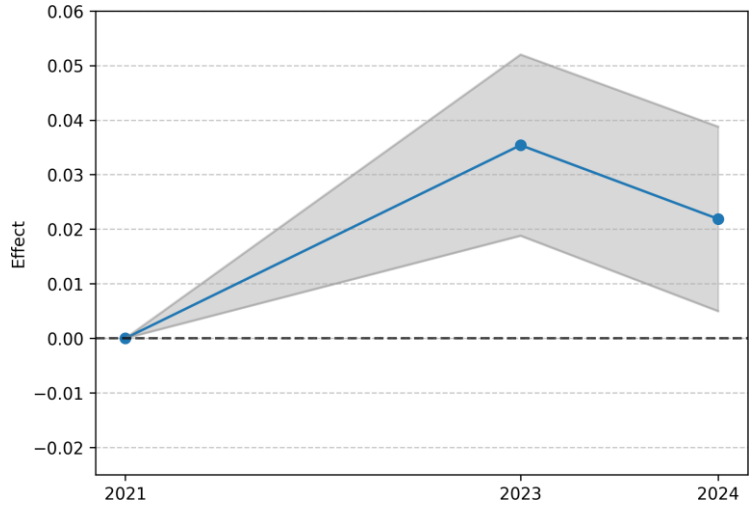
Table 2: Regression results

	(1)	(2)	(3)	(4)	(5)
	Flood threat?	**Wealth**	**Savings**	**LTV**	**ratio**
				Origin.	Current
Owns at-risk property	0.09**	0.04	-0.10	-0.10	-1.43
	[0.01]	[0.04]	[0.07]	[1.51]	[1.48]
Owner characteristics					
Male	0.01	0.07*	0.09	4.00*	-0.17
	[0.01]	[0.03]	[0.05]	[1.75]	[1.71]
Age: 16 - 34	0.00	-0.41**	-0.07	-3.92	0.28
	[0.03]	[0.11]	[0.11]	[2.60]	[3.68]
Age: 50 - 64	-0.02	0.41**	0.30**	-10.26**	-18.67**
	[0.02]	[0.06]	[0.09]	[1.97]	[2.17]
Age: 65+	-0.04**	0.54**	0.40**	-25.35**	-33.67**
	[0.01]	[0.06]	[0.09]	[2.24]	[2.05]
Income: 0 - 30K	-0.00	0.02	-0.03	-0.83	-1.96
	[0.01]	[0.03]	[0.05]	[1.71]	[1.29]
Income: over 50K	0.01	0.09**	0.09	-1.78	-0.52
	[0.01]	[0.03]	[0.05]	[1.52]	[1.37]
Income: NA	-0.01	-0.01	-0.16**	0.98	-0.60
	[0.01]	[0.04]	[0.05]	[1.63]	[1.39]
Has university degree	0.02	0.27**	0.44**	0.32	-1.03
	[0.02]	[0.07]	[0.09]	[2.21]	[2.17]
Prior damages					
- By earthquake	-0.08**	-0.03	0.01	2.30	0.64
	[0.01]	[0.05]	[0.09]	[2.48]	[2.21]
- By flood	0.16*	-0.26*	0.05	4.52	-3.28
	[0.06]	[0.10]	[0.14]	[5.00]	[2.76]
Trusts flood protection	0.01	0.00	0.07	-0.49	-1.20
	[0.01]	[0.03]	[0.05]	[1.50]	[1.34]
Observations	5,142	3,920	4,354	1,597	1,703
R^2	0.05	0.13	0.05	0.16	0.25

Notes: Selected coefficients and standard errors (clustered by household) for random effects panel regressions. Dependent variables are a binary dummy indicating whether respondent sees flood as main threat to her property (column 1); household financial wealth (in logs, column 2); household savings (in logs, column 3); the LTV ratio, either at origination (column 4) or most recent (column 5). The main explanatory variable indicates whether the respondent owns a property that is located in a flood zone. The covariates include owner characteristics (e.g. age) and binary dummies indicating prior types of damages to the property. $^{*}p < 0.05$, $^{**}p < 0.01$.

Given that we have three survey waves, we can also assess variation over time. We find that awareness has increased significantly since the spring of 2021, i.e. the time of the first survey wave. Figure 1 shows year fixed effects that are positive and statistically significant, reinforcing the notion that at-risk owners are increasingly seeing flooding as a threat. A possible explanation for this increased awareness lies in the two recent episodes in which flood risks materialized, i.e. the severe flooding in Limburg in 2021 and the instances of high water during Christmas 2023. These events likely reinforced the urgency of flood risk in the minds of at-risk owners. However, Figure 1 also indicates that the increase since 2021 is not linear. Between 2023 and 2024 there is a small—though not significant—decline in the coefficient for the year fixed effect.[15]

Figure 1: Flood awareness over time



Notes: Coefficients and 95% confidence intervals for year fixed effects in column 1 of table 2. The baseline estimate is for the 2021 survey wave.

[15]Looking at averages per year, we can see the pattern in Figure 1 is mainly due to at-risk owners. Results available upon request.

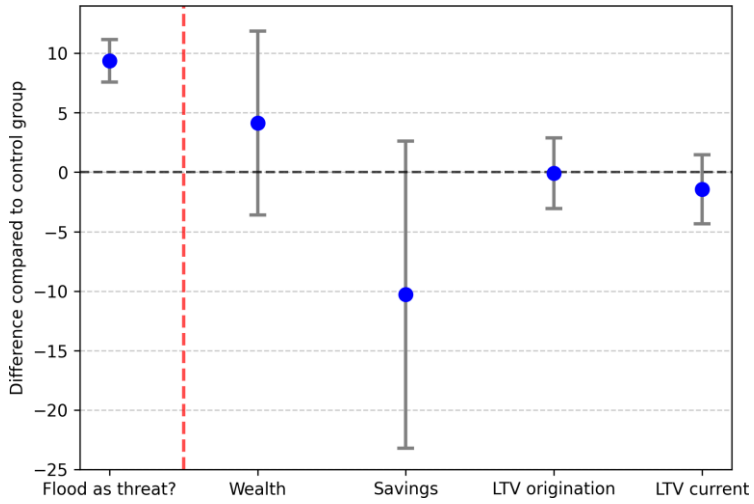
Despite increased awareness, we observe no significant differences in financial resilience between at-risk homeowners and those in the control group. There is no significant difference for owning an at-risk property in wealth (column 2) and savings (column 3).[16] Finally, we observe no significant differences in LTV ratios, either at origination (column 4) or the most recent value for the LTV ratio (column 5), between at-risk and non-risk homeowners. Given that the literature has mainly focused on adaptation so far, we think this disconnect between awareness and financial resilience is a main contribution of this paper.

Regarding the socio-economic covariates, there are various significant differences for the wealth variables. We find wealth and savings are higher for older respondents with higher income levels that have a university degree. For the two LTV ratios, we only find significant differences related to age. Older respondents report having lower LTV ratios, both at origination and most recently.

Based on the panel regressions, Figure 2 presents a visualization of the main results. The figure reports coefficients (blue dots) and the associated 95% confidence intervals (gray vertical lines) for flood awareness and financial resilience. The first element of Figure 2 illustrates a difference across the two groups. At-risk homeowners are 9 percentage points more likely to report flood as the main threat to their property. At the same time, as indicated by the other four lines in Figure 2, there are no significant differences for financial wealth, savings, or LTV ratios.

[16]In addition to the marginal effect estimated in the panel regressions, Figure A.1 suggests that the wealth distributions for at-risk owners and the control group are also quite similar.

Figure 2: Owning an at-risk property: effects on awareness and resilience



Notes: Estimated coefficients and 95% confidence intervals for five variables. 'Flood as threat?', 'LTV at origination' and 'current LTV' are presented in percentage point differences. 'Wealth' and 'Savings' is presented as percentage difference. Coefficients represent the difference between at-risk homeowners and a control group living outside a flood zone.

Lastly, we consider two extensions to our baseline analysis. First, we incorporate awareness of flood risk by including the variable that captures whether respondents perceive flooding as the primary threat to their property. While the *AtRisk* variable provides an objective, model-based assessment of flood exposure, individuals' perceptions may be more directly linked to their financial behaviour. If a household feels threatened by flooding, this perceived risk could serve as a stronger motivator for precautionary financial decisions, such as increasing savings. Second, we explore the interaction between perceived flood threat and the objective *AtRisk* measure. This allows us to test whether the behavioural response to perceived risk is amplified when the objective risk is also high.

Table 3 presents the regression results for these two extensions. The results are in line with our baseline regression. There is no direct effect of higher awareness on financial resilience in terms of wealth, savings and LTV ratios. Also, the interaction term between the awareness variable and *AtRisk* does not have a significant coefficient.

Table 3: Regression results for two extensions

Regression		(1)	(2)	(3)	(4)
		Wealth	**Savings**	**LTV ratio**	
				Origin.	Current
(1)	Flood as threat?	0.04	0.00	-42.85	0.58
		[0.03]	[0.05]	[28.66]	[1.64]
(2)	Flood as threat? x AtRisk	0.00	-0.02	134.68	-3.65
		[0.10]	[0.12]	[147.61]	[7.12]

Notes: Selected coefficients and standard errors (clustered by household) for eight panel regressions. Dependent variables are household financial wealth (in logs, column 1); household savings (in logs, column 2); the LTV ratio, either at origination (column 3) or most recent (column 4). In the regressions in row (1), the main explanatory variable indicates whether the respondent sees flood as the primary threat to their property. In the regressions in row (2), the main explanatory variable is the interaction term between the awareness variable and the *AtRisk* variable. The covariates include owner characteristics (e.g. age) and binary dummies indicating prior types of damages to the property. $^{*}p < 0.05$, $^{**}p < 0.01$.

4 Conclusions

This paper examines the relationship between flood risk awareness and financial resilience among Dutch homeowners. Investigating this connection is, to the best of our knowledge, new to the literature. Our findings suggest a degree of disconnect between these two dimensions.

On the one hand, homeowners in flood-prone areas are increasingly aware of the risks. From the perspective of the Protection Motivation Theory (Rogers, 1975; Rogers, 1983), this finding indicates that threat appraisal is growing. However, this awareness appears to be most pronounced in the immediate aftermath of flood events. Moreover, the proportion of at-risk homeowners who identify flooding as the primary threat (12.1%) remains low compared to the actual share of at-risk properties.

On the other hand, we find no evidence that changing threat appraisal is matched by greater financial preparedness. In the absence of insurance coverage against major floods, we focus on a range of broad metrics for financial resilience. First, we find no significant differences in terms of wealth between at-risk owners and a control sample. Second, we find no differences in terms of LTV ratios, either at origination or more recent. From the perspective of PMT, this suggest that coping appraisal is not yet growing.

Several factors may explain the degree of disconnect between awareness and financial resilience. First of all, it may reflect that the Dutch general public has a large degree of trust in flood protection measures. Of the survey respondents, more than 80% report that they perceive the strength of Dutch flood protection as strong. Therefore, homeowners may assess the probability and impact of flood to be low and, therefore, see less need to financially prepare for such eventualities.[17]

Second, the disconnect may follow from homeowners' expectations regarding government support following flood events. At present, the Dutch government can decide to provide financial compensation after natural dis-

[17]See also Jansen (2024) for further discussion on the role of trust in flood protection.

asters. This *ex post* approach follows from the 'Wet tegemoetkoming schade bij natuurrampen' (in short: Wts). Currently, this *ex post* approach may be sufficient to mitigate potential financial stability effects of flood events. But, there is also debate on whether this approach will remain effective over the longer run (Engelhard et al., 2024). Likewise, discussions about an *ex ante* private/public insurance approach are on-going (see, e.g., DNB (2022) or ECB/EIOPA (2024)). As risk awareness is growing, an *ex ante* approach might offer at-risk owners a more direct course of action to cope financially with the potential consequences of major flood events. In any case, aligning risk awareness and protection behaviour is important to ensure the financial resilience of households and thus safeguard financial stability in the face of future climate-related physical shocks.

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Appendix

A.1 Survey questions

This appendix gives the wording of two relevant questions on climate-related threats to properties. Members of the Centerpanel were invited to answer these questions (alongside a number of other questions) at three points in time, namely spring of 2021, 2023 and 2024.

Q1: Which of these following events is, according to you, the largest threat for your current place of residence?

1. Soil subsidence
2. Extreme precipitation (rain and/or hail)
3. Floods (sea)
4. Floods (rivers)
5. Wind speeds
6. Drought
7. Weakening foundations
8. An earthquake
9. I do not know

Q2: Have you ever experienced that the following events in the Netherlands caused damage to your residence?

- An earthquake
- Wind speeds
- Floods (sea/river)
- Extreme precipitation

A.2 Construction of financial wealth

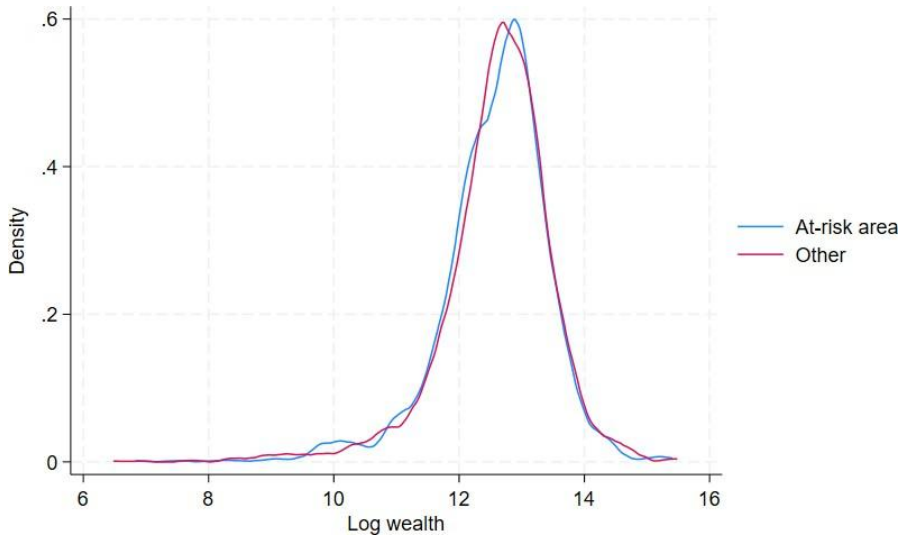
This table gives an overview of the assets and liabilities used to compute household financial wealth.

Assets	**Liabilities**
Payment accounts	Mortgages on immovable property
Savings and deposit accounts	Personal loans
Savings passbooks	Revolving, financing and other credits
Savings certificates and notes	Loans from friends or family
(Covered) bonds	Other loans
Shares and substantial interest	Student loans
Investment funds and accounts	
Single premium life insurance policies and annuity insurance policies	
Savings and capital insurance policies	
Cash value life insurance mortgage for real estate	
Company savings account	
Other assets/savings or investments	
Loans to family or friends	
Immovable property	
Business capital	
Cars, motors, boats, caravans	

Table A.1: Components of financial wealth

A.3 Household wealth and flood risk

Figure A.1: Household wealth and flood risk



Notes: Fitted distribution of household wealth (in logs) for at-risk homeowners (blue line) and a control group of owners living outside a flood zone.

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