Communicating Effectiveness:
An Experiment on Insurer Advice and Homeowners' Willingness to Invest in Risk Mitigation Measures

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Spring 2026

Abstract

Climate change is increasing flood-related risks for homeowners and insurers, making household-level risk mitigation measures increasingly important. This thesis examines whether insurers can increase Swedish homeowners' willingness to invest in flood barriers by emphasizing the response efficacy (i.e., effectiveness) of the measure in their risk communication. The study uses a survey experiment with Swedish homeowners recruited through Norstat. Respondents were randomly assigned to one of two vignette scenarios: an insurer recommendation to invest in flood barriers either with or without an added paragraph emphasizing that the barriers reduce flood damage. The final sample consisted of 302 respondents. The analysis included t-tests, regression analyses, mediation analyses, and moderation analyses. The experimental manipulation did not significantly increase perceived response efficacy or willingness to invest, meaning the main experimental hypothesis was not supported. However, exploratory analyses showed that perceived response efficacy was strongly and positively associated with willingness to invest. Expected property value increase, trust in insurer advice, and lower perceived effortfulness were also associated with higher willingness to invest. Trust and expected property value gains partly explained the relationship between perceived response efficacy and willingness to invest.

Keywords*: Risk communication, insurance, climate change, advice, risk mitigation measures*

Acknowledgements

We would first like to thank our supervisor Nurit Nobel for her valuable support and guidance throughout the entire project, as well as being available for meetings even of spontaneous nature. Secondly, an employee at Svensk Försäkring helped setting us on the path of researching the intersection between insurance, climate change, and risk communication by providing insights into the topics which are most relevant in the field of insurance. Lastly, we want to thank Henrik Kronberg at Norstat Sverige AB for providing the responses needed for the data collection.

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1. Introduction

So far, the current decade has included some of the warmest years on record with natural perils such as extreme heat events, heavy precipitation and floods having increased in frequency and severity all around the world. Europe is the fastest warming continent on earth with extreme precipitation and flood risks being especially prominent and expected to become more devastating and common as the climate continues to warm (EEA, 2024). Human activities have increased the emission of greenhouse gases through unsustainable energy use, land use and heavy consumption and production patterns, contributing to the rising global surface temperature (IPCC, 2023). Sea level rise in Europe is accelerating in pace, which leads to heightened risks of coastal floods and storms, posing a threat to cities and ecosystems around the continent. Further, even in a scenario where global temperatures stabilize, sea levels will continue rising for several centuries to come due to deep ocean warming and melting of ice sheets (EEA, 2024; IPCC, 2023).

The strengthening of the hydrological cycle has already increased and will continue to raise the likelihood of flood-related events such as heavy precipitation, river flooding, and coastal flooding. Furthermore, the rising sea level increases coastal flood exposure and can worsen storm-surge impacts. When high sea levels and heavy precipitation occur simultaneously, the effects compound and further increase the flood risk (IPCC, 2023). The EEA's European Climate Risk Assessment (EUCRA) highlights flooding as a major and urgent European climate risk. EUCRA also emphasizes the same compounding mechanisms brought up in the IPCC report, with coinciding sea-level rise and heavy precipitation increasing the severity and frequency of coastal flooding (EEA, 2024). A defining feature of flood-related hazards and losses is their concentration in a small number of high-impact events, which can overwhelm local coping capacity and trigger broader cascading effects (Calvin et al., 2023; EEA, 2024). The economic consequences can extend beyond the initial damage, affecting insurance markets and household recovery (EEA, 2024; Sveriges Riksbank, 2025). Risk mitigation strategies are therefore crucial for climate resilience and protecting economic systems, infrastructure, and communities.

While current institutional measures such as flood defenses and early-warning systems play a critical role, they cannot fully eliminate risk and may make properties and communities more vulnerable due to increased reliance on the measures (IPCC, 2023; Kunreuther, 2006). Households therefore represent a crucial line of defense, yet adoption of private

risk-mitigation measures has historically been low (Kunreuther, 2001, 2006). Research points to several barriers including that homeowners often underestimate their personal exposure (Kunreuther, 2001) and rely on government protection (Botzen et al., 2009; Kunreuther, 2001; The Economist, 2024). Even when awareness is high, perceived personal risk does not necessarily translate into action (Grahn & Jaldell, 2019). The measures adopted by private individuals to protect their homes against natural perils have been covered by various terms in the existing literature. In the current research, the measures will henceforth be denoted *risk mitigation measures (RMM)* for consistency (Kunreuther, 2001). A central barrier to adoption is a lack of knowledge about measures and perceiving these to be ineffective at mitigating flood risks (Grahn & Jaldell, 2019). Individuals' psychological perceptions of the efficacy of RMMs and their own ability to carry out protective actions have been proven to be strong predictors of adoption behavior (Botzen et al., 2009; Bubeck et al., 2012; Grothmann & Patt, 2005; Lindell & Perry, 2012; van Valkengoed & Steg, 2019).

Swedish insurance companies play an important role in promoting risk mitigation behavior because they offer compensation to policyholders in the event of damages by natural perils (Finansinspektionen, 2026). Advocating for investments in RMMs becomes increasingly relevant for insurers as climate risks challenge the core principle of insurability, namely the ability to pool independent risks, and insurers may face rising claims and increasing difficulty in diversifying and pricing correlated risks (Finansinspektionen, 2026). Thus, insurance companies have the incentive to limit the risk-exposure of insured assets, and direct communication with homeowners, positioning them to play a meaningful role in promoting private adaptation. However, existing research has shown that risk communication primarily focuses on engagement and attention and calls for engaging several stakeholders by providing information on protective actions and investments (OECD, 2016; Steelman & McCaffrey, 2013).

This raises an important question: can insurers increase willingness to invest in risk mitigation measures by framing their communication around the proven effectiveness of those measures? The purpose of this thesis is to examine how efficacy framing in insurer communication affects Swedish homeowners' willingness to invest in risk mitigation measures. Specifically, it tests whether adding a paragraph emphasizing the effectiveness of a flood barrier increases willingness to invest compared with an otherwise similar message that does not include efficacy information. The thesis contributes to an on-going discussion about

what drives adoption of household-level RMMs and how insurers can improve their risk communication to strengthen climate resilience and increase household engagement.

2. Research and Hypotheses

2.1 Theoretical background

2.1.1 Economic losses & Cascading effect

Cascading effects describe how an initial climate hazard (e.g., a flood) triggers indirect, second-order consequences that propagate across interconnected systems. In the literature, cascading effects are often treated as a defining feature of "systemic" (i.e. affects entire system rather than individual components) climate risk, where one direct shock generates multiple follow-on risks across economic and social domains (Li et al., 2021). This systems perspective is also central in the European Climate Risk Assessment (EUCRA), which frames climate change as a risk multiplier and explicitly notes that climate risks can cascade across sectors and regions, producing society-wide challenges and disproportionately affecting vulnerable groups (EEA, 2024). Furthermore, a key characteristic of climate-induced systemic risk is that the impacts accumulate and effects are magnified over time (Li et al., 2021).

The relevance of cascading effects becomes clear when considering the scale and structure of observed losses. In the EU, weather- and climate-related extremes caused estimated asset losses of EUR 822 billion (2024 prices) during 1980-2024, with more than a quarter (EUR 208 billion) occurring in 2021-2024 alone. Flooding is a major driver within this total, as hydrological hazards account for about 47% of these losses (EEA, 2025). The distribution of losses is also highly skewed: the EEA reports that 5% of events account for 59% of losses, and 1% account for 37%, illustrating the importance of low-probability, high-impact events that can overwhelm coping capacity and trigger broader cascades (EEA, 2025). Globally, it is estimated that total economic losses from disaster events amounted to USD 318 billion in 2024, with 57% uninsured, implying a large protection gap of USD 181 billion (Banerjee et al., 2025). It is further noted that global insured losses have followed a 5-7% real annual growth trend in recent years, consistent with a risk landscape where large shocks are becoming increasingly consequential for insurers and the wider economy (Banerjee et al., 2025).

A core aspect of cascading effects relevant to flood risk runs from physical damage to insurance markets and household recovery. Insurance can accelerate rebuilding and stabilize households' finances, however, both European and global evidence indicates that a significant share of losses remains uninsured, especially for flood perils (EEA, 2025; Banerjee et al., 2025). In Europe, the EEA estimates that less than 20% of total losses were privately insured over 1980-2024, and hydrological events have lower insured shares than storms (EEA, 2025). The Climate Resilience Dialogue's final report defines the "climate protection gap" as the difference between economic and insured losses and argues that, without both growth in resilience and coverage, the gap is likely to widen (Climate Resilience Dialogue, 2024).

Intensifying climate impacts may increase insurance premiums, widen the protection gap, and worsen vulnerability among low-income households and other disadvantaged groups (EEA, 2024). The Swedish Central bank, Riksbanken (2025), similarly emphasizes that insurers are directly exposed to climate events through household and business policies with their costs expected to rise along with rising risks of natural disasters and extreme weather. Riksbanken also points to an international debate about insurer withdrawal and affordability, describing this as an "insurance gap," and warns that reduced coverage can lower recovery prospects for households and firms (Sveriges Riksbank, 2025). If premiums rise or coverage becomes constrained, households may face stronger incentives to reduce vulnerability, but also tighter financial constraints and heightened inequality in who can invest (EEA, 2024; Sveriges Riksbank, 2025).

Downstream, uninsured or underinsured losses can be transmitted to the banking system via collateral and credit channels. While Swedish protection against natural events remains high today, there is a link between reduced insurance coverage and higher bank credit risk when the value of collateral deteriorates (Sveriges Riksbank, 2025). At an EU level, the European Central Bank (ECB) and European Insurance and Occupational Pensions Authority (EIOPA) argue that lack of insurance can slow economic recovery and increase banks' exposure to credit risk, while also weakening fiscal positions of governments that step in to cover uninsured losses (ECB & EIOPA, 2024). These financial cascading effects are particularly relevant in mortgage-heavy systems, where property values and insurability affect both household wealth and the stability of secured lending (ECB & EIOPA, 2024; Sveriges Riksbank, 2025)

Overall, the cascading-risk perspective strengthens the rationale for studying household investment in RMMs and the role of insurers as potential "adaptation intermediaries." EUCRA emphasizes that stress tests and risk assessments should better include cascading, compounding, and extreme-event risks (EEA, 2024). It also calls for insurance approaches that encourage vulnerability reduction while keeping coverage affordable, and warns that ignoring indirect consequences can lead to poor prioritization. Thompson et al. (2024) show that incorporating cascading impacts can increase assessed risk and shift adaptation prioritization. This motivates the focus on behavioral drivers (insurer-provided advice) that may move households toward RMMs, thereby reducing losses at the source and dampening cascades through insurance markets, bank balance sheets, and public finances (EEA, 2024; Sveriges Riksbank, 2025).

2.1.2 Current adaptations

Institutional adaptations are planned efforts aimed to protect communities and facilitate disaster recovery which can include building physical infrastructure (e.g. tide gates or seawalls), maintenance of critical transportation infrastructure, and even government disaster recovery funds. These adaptations are foundational measures for ensuring that households are willing to invest in their own properties as residents assume that the area will remain accessible and habitable (Castro, 2024). Meanwhile, households' independent RMMs are based on local knowledge and their available resources. For communities that are inadequately protected by government programs or insurance, these measures are critical to mitigate damages against their properties. Risk mitigation measures can include costly but effective elevation of houses, raising yards and parking spots to keep floods away from the property, or upgrading the property with, for example, more resilient windows or flooring (Castro, 2024).

The IPCC report stresses that adaptation is occurring, especially within water-related risks, with adaptation to water-related risks and impacts making up around 60% of all adaptations. It frames effective flood risk reduction as mainly a combination of non-structural measures such as early warnings and preparedness along with structural measures such as barriers or floodproofing or properties and infrastructure. Nature-based approaches such as wetland restoration and urban greening could also be effective (IPCC, 2023). However, the adaptation gap continues to increase as current efforts are insufficient relative to the pace of risk increase. Should the adaptation gap persist or increase during the current level of

implementation, responses risk becoming incremental or fragmented rather than transformative. Those measures that are effective today will become obsolete if the trend with climate change remains, causing significant damage and losses to constrain adaptation options for societies and natural systems. Seawalls, for instance, reduce the adverse effects in the short term by protecting humans and assets but increases exposure and vulnerability in the long term as communities become dependent on measures that become difficult to upgrade or remove (IPCC, 2023). Consequently, developers must design resilient homes and homeowners must adopt measures themselves (Kunreuther, 2006). Furthermore, if mitigation and adaptation measures are not integrated and implemented into a long-term plan, societies, individuals and assets are unlikely to be able to absorb the cost-escalation following a warming climate.

Adoption of RMMs have seemingly been low to date despite increasing damages from perils. Kunreuther (2001) highlight that individuals underestimate the risks while considering only a short time horizon which does not justify the up-front cost. Experience from disasters in the US shows that homeowners are reluctant to invest in measures even when they are aware of the large damages people in their surroundings have incurred from recent disasters (Kunreuther, 2001). Another dominant barrier to household adoption is perceptions of the government being responsible and expectations to receive state-funded disaster reliefs (Botzen et al., 2009; Kunreuther, 2001; The Economist, 2024). The IPCC (2023) further highlights several key barriers to adaptation such as limited research on feasible adaptations, as well as limited private sector and citizen engagement, political commitment, and sense of urgency.

2.1.3 The evolving role of insurers

Swedish insurance companies are presently offering insurance against natural perils as part of the overall housing insurance and can be considered a strong protection for policyholders today (Finansinspektionen, 2026). However, with heightened risks for natural disasters, insurance companies are expected to raise insurance premiums in relation to the increased risk and cost of damages (EEA, 2024; Sveriges Riksbank, 2025). In addition, properties are likely to be evaluated and priced to a greater extent according to individual risk-profiles of policyholders and properties. Long-term, insurance companies might even cease to offer insurance for properties in high-risk areas (Finansinspektionen, 2026). Consequently, residents in high-risk areas are faced with heightened vulnerability, with their insurance being

priced higher, or their properties being covered to a lesser extent. Thus, reduced coverage may lead to higher inequality, while the possibilities of recovery for households and firms are constrained (Sveriges Riksbank, 2025).

Natural perils often do not damage properties in isolation, which violates a core principle of insurability, namely that insurance companies spread risk among many assets with risk that is independent from other assets. Along these lines, it is in insurers' interest to reduce risk while retaining customers (Bassetti, 2025). The constraints climate change impose on the feasibility of offering insurance makes it relevant for insurers to consider how they and their policyholders can reduce risk levels of insured properties.

From the homeowners' perspective, the risks and limitations that climate change impose on insurance pricing and availability may make climate risks more observable and personally relevant, motivating them to adapt their properties to a changing climate. Insurance companies can for example incentivize their customers to invest in RMMs by rewarding risk-reducing adaptations with reduced premium (Finansinspektionen, 2026). Furthermore, The Climate Resilience Dialogue emphasizes that increasing consumer access to clear risk information and prevention options can raise risk awareness and preparedness, and it treats risk reduction as a precondition for insurability as climate impacts intensify (Climate Resilience Dialogue, 2024).

2.1.4 Consumer attitudes and perceptions

With the uncertainty and volatility of climate impacts combined with house prices seemingly not adjusting to climate risk, homeowners may be unknowing regarding the risk associated with their purchases of homes. Additionally, house prices only reflect the risks retroactively after natural disasters when the time for investments in RMMs has passed (The Economist, 2024). However, it is in homeowners' interest to consider the risks associated with owning a particular property for several reasons. As mentioned previously, insurers are expected to increase insurance premiums or withdraw coverage from especially high-risk areas which could impact individuals' willingness and possibility to buy insurance. This in turn impacts their ability to finance their home purchases as housing insurance is a prerequisite for banks to offer mortgage loans (Finansinspektionen, 2026).

Homeowners play a central role in terms of reducing their properties' susceptibility to climate risks and ultimately decide on the RMMs they want to undertake. It is therefore crucial to understand the factors that influence consumer risk perceptions. Furthermore, as insurers'

role in society changes and evolves with climate change it is crucial for them to understand how to promote and incentivize consumer behavior.

2.1.4.1 How nearby events shape risk perceptions

A major challenge in climate adaptation relates to the psychological distance between risks and people. According to construal-level theory, psychologically distant risks tend to be construed more abstractly, as opposed to psychologically proximate risks, which tend to feel more concrete and actionable (Trope & Liberman, 2010). In practice, this suggests that reducing the perceived distance could be done through "proximizing" information by connecting hazards to the recipient's local area, leading to increased attention, engagement, and intention to act. These effects can however depend on how credible, interpretable, and action-oriented localized information is (Moser, 2014).

Evidence for the importance of spatial proximity can be found in research on localized visualization. Ballantyne et al. (2018) show that when Nordic homeowners used an interactive home-specific climate risk visualization tool, they relied on local cues and recognizable landmarks to interpret risk information in a more personally anchored way. This supports the idea that framing climate impacts as local rather than purely global can motivate adaptation by making risks feel more relevant to one's lived environment. However, localized information does not automatically increase concern. Ballantyne et al. (2018) find that some participants judged local risks as low or questioned the reliability of localized outputs, suggesting proximity cues may raise attention without increasing perceived threat. To translate engagement into action, messages likely need to be interpretable, credible, and concrete, including feasible options that reduce uncertainty about what homeowners can do (Ballantyne et al., 2018; Moser, 2014).

Beyond visualization, direct experience of damage is a strong driver of beliefs about future local hazards. Lujala et al. (2015) find that personal experience of events such as floods or landslides predicts expectations of more local hazards, whereas simply living in a more exposed area without damage experience does not increase concern in the same way.

The importance of nearby events and proximity in adaptation communication is also supported by behavioral evidence from insurance markets. Gallagher (2014) shows that flood insurance take-up increases shortly after a flood, before gradually declining toward baseline. Importantly, even residents in non-flooded communities within the same television market increased take-up, although at roughly one third of the rate observed in flooded communities.

This suggests that information about nearby floods can shape protective behavior even without direct losses, but that the effect may fade as the event becomes less salient.

Similarly, Nobel & Hiscox (2025) show that simple localized cues can increase engagement with preparedness information. In a field experiment with Australian homeowners in wildfire-prone areas, messages including a proximal cue, the recipient's suburb, substantially increased information-seeking compared with generic messages. Although the outcome was engagement rather than actual investment, the findings suggest that localized insurer communication referencing a homeowner's municipality, neighborhood, or recent nearby flood could increase attention and information-seeking, potentially serving as a precursor to investments in RMMs.

2.1.4.2 How risk perceptions shape behavior

A common premise in risk mitigation research revolves around how higher perceived risk motivates households to invest in measures to protect their homes. Risk perceptions tend to shape behavior indirectly, through homeowner's attitudes, intentions, and perceived ability to act. The Theory of Planned Behavior suggests that homeowners' behavior is driven by intentions, which is in turn formed by attitudes towards the behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). In the context of risk mitigation and flood-risk, expected climate impacts can be understood as inputs into attitudes, rather than direct triggers of investment.

In the direct context of household investments in RMMs, risk perceptions and proximity appear to be linked to willingness to invest in these measures. Botzen et al. (2013) examine willingness to invest in elevating newly built homes to eliminate flood risk. The study finds that willingness to invest is positively associated with expected negative impacts of climate change and with perceived flood risk, especially among those living close to a main river (Botzen et al., 2013). The logic of risk perceptions leading to changed attitudes and subsequently action is also supported in a Kronoberg case study on climate-smart renovations, where it was found that attitudes were strongest predictors of adoption behaviors, and that these attitudes are closely tied to beliefs about climate change impacts. Their results imply that the homeowners' perceptions of how climate change will affect them in their everyday life are central for whether investments in RMMs occur (Sinha et al., 2025). These findings are consistent with The Theory of Planned Behavior's emphasis on attitudes as key determinants of intention and behavior (Ajzen, 1991).

However, other flood-specific studies show that elevated awareness is often necessary but not sufficient. In a Swedish survey of households in flood-prone areas, it was found that homeowners who had implemented RMMs were more likely to have past flood exposure, to report a greater personal responsibility and knowledge on personal risk reduction, and to view public risk reduction as insufficient (Grahn & Jaldell, 2019). Additionally, related evidence also suggests that awareness of climate risk can coexist with low perceived personal risk and weak adoption of RMMs. Bichard and Kazmierczak (2011) found when studying homeowners in England and Wales that awareness of climate change and flooding was high, but perceived risks were often judged as low, with few homes having property-level flood protection. Instead, respondents believed that public authorities have primary responsibility for flood protection. This illustrates a key boundary condition: awareness of flood-risk and climate issues does not necessarily produce a sense of personal exposure or responsibility, which are important drivers for willingness to pay and adoption of measures (Bichard & Kazmierczak, 2012).

Risk perceptions can also influence outcomes through short-term, situational awareness, especially relevant for pluvial flooding where warning, time, and immediate actions can reduce damages. Multivariate flood damage models show that non-hazard indicators matter alongside flood depth. Notably for this study, being aware of the risk shortly before water enters the building is associated with substantially lower contents damage, underlining the value of warnings and preparedness actions (Van Ootegem et al., 2015). While this is not an investment in RMMs, it demonstrates the behavioral pathway where heightened awareness and risk perceptions translate into action that can reduce losses.

Importantly, the relationship between higher risk perceptions and behavior depends on institutional context and perceived protection. (Jansen, 2024) finds that Dutch homeowners with properties at flood risk are more likely to identify flooding as their main threat, but this does not fully translate into adaptive behavior, with the effect being moderated by trust in flood protection systems. Although this study brings up mitigation measures, in this case improving energy efficiency, as opposed to floodproofing, it still highlights the fact that mere perceived risk does not uniformly increase adaptation behavior, and high trust in external protection may dampen motivation.

Finally, consumer research outside of flooding still supports a general behavioral link between perceived climate risk and willingness to invest in RMMs. In a study on

homeowners from the southern United States, respondents placed higher value on climate-resilient and stress-tolerant turfgrass attributes as climate risk perceptions increased (Jung et al., 2026). This strengthens the broader claim that perceived climate risk can increase valuation of protective attributes, even if the specific product differs from flood adaptation measures.

2.1.4.3 Perceived Efficacy

Spatial proximity and previous personal experience have been shown to increase risk perception but might not necessarily translate into action if homeowners lack knowledge about measures and perceive these to be ineffective at mitigating flood risks (Grahn & Jaldell, 2019). Past research using the Model of Private Proactive Adaptation to Climate Change (MPPACC) (Grothmann & Patt, 2005), Protection Motivation Theory (PMT) (Bubeck et al., 2012; Grahn & Jaldell, 2019) and the Protective Action Decision Model (PADM) (Lindell & Perry, 2012) explore how psychological factors, namely response-efficacy and self-efficacy, are more powerful predictors of homeowner's willingness to invest in risk mitigation measures.

The extent of which an individual believes that a specific protective action will be effective in reducing or avoiding damage to themselves or their property has been inconsistently termed in prior literature. Previous entries include *adaption efficacy* (Grothmann & Patt, 2005), *outcome efficacy* (van Valkengoed & Steg, 2019), *hazard-related attributes* (Lindell & Perry, 2012) and *response efficacy* (Bubeck et al., 2012). For consistency reasons, we will henceforth use *response efficacy*. *Self-efficacy* has consistently been used to describe an individual's perceived ability or capability to carry out the response (Bubeck et al., 2012; Grothmann & Patt, 2005).

Response efficacy is shown to be a strong predictor of adaptive behaviour, even surpassing risk perception or past disaster experience (van Valkengoed & Steg, 2019). Along these lines, research has found that the relationship between past experience and future action is fully mediated through perceived vulnerability and perceived response efficacy (Zaalberg et al., 2009). Research on flood-mitigation measures finds that households located at too low altitudes for water barriers to be effective are less likely to invest in the measures while living close to a main river increases the likelihood (Botzen et al., 2009). This implies that the perceived effectiveness of measures is a factor influencing consumers' willingness to invest in RMMs. However, even if a homeowner has the resources (i.e., money, time, or

knowledge), a lack of perceived self-efficacy can act as a major cognitive bottleneck for adoption behaviour which results in a low likelihood of forming adaptation intentions (Grothmann & Patt, 2005). Similarly, higher levels of perceived self-efficacy increase adoption behaviour (van Valkengoed & Steg, 2019).

Protective actions require both an individual's high risk perception and a strong belief in the effectiveness of the measures and their own capabilities (Bubeck et al., 2012). If a homeowner perceives a high risk but low efficacy (of measure and themselves), they may engage in denial or wishful thinking to manage their fears (Bubeck et al., 2012; Grothmann & Patt, 2005). Lastly, another closely related component to self-efficacy is the perceived costs (e.g. time, money, or effort) associated with the protective action (Grothmann & Patt, 2005) where people are more likely to invest when they perceive high efficacy for relatively low personal costs (Lindell & Perry, 2012).

2.1.4.4 Economic incentives to invest

Homeowner's adaptations require upfront investments which are immediate and might require them to cut spending in other areas of their lives while the damages these investments are meant to prevent are uncertain (Kijewski-Correa et al., 2023). Despite homeowners recognizing that investing in measures could help avoid economic losses, they rarely undertake these investments because they underestimate future losses and how vulnerable they are to natural disasters (Kunreuther, 2006). The belief that the RMMs will provide economic benefits is therefore one aspect which could make individuals overcome financial constraints. Besides the measures' ability to prevent future losses (i.e., efficacy), economic incentives can be in the form of receiving insurance discounts, subsidized loans, or property appreciation (Kijewski-Correa et al., 2023).

Botzen, Aerts and van den Bergh (2009) finds that many Dutch homeowners are willing to invest in RMMs (e.g. water barriers, floor replacement, or relocating central heating installations) in exchange for a premium reduction. This is further supported by Kunreuther (2001) who points toward insurance as an incentive for governments and citizens to adopt measures in exchange for reduced premiums. Hence, insurers can incentivize consumers to reduce the risks associated with climate change by providing premium discounts or higher degrees of (or not restricting) coverage.

Research suggests that efficacy might strongly motivate adaptations for relatively affordable RMMs (e.g. sandbagging or waterproofing basements) but for whole-house adaptations,

conventional messaging of efficacy fails to drive adaptation behavior. Instead, a belief that the investment will yield an increase in market value of the home increases the likelihood of homeowners upgrading their properties (Kijewski-Correa et al., 2023).

2.1.5 Risk Communication

In the context of flood risk and household adaptation, communication from insurers can be understood through the lens of risk communication, as it involves conveying information intended to influence how individuals perceive and respond to potential future risks (Moser, 2014; Steelman & McCaffrey, 2013). A defining feature of risk communication is that it should be conveyed before a disaster has occurred to raise awareness so that stakeholders can take precautionary action (OECD, 2016). This contrasts to crisis communication which focuses on distributing useful and timely information during a crisis (OECD, 2016; Steelman & McCaffrey, 2013). The OECD frames effective risk communication as increasing awareness regarding exposure, vulnerability, and measures stakeholders can take to address disasters. However, they argue that current risk communication focuses too little on informing stakeholders about the measures they can employ to reduce their own exposure to risk. Risk communication is especially crucial for high-impact, low-probability events as long periods without disasters make people forget about underlying risks (OECD, 2016). However, research has primarily focused on risk communication at the hands of governments with limited research on the role of private actors such as insurers.

Consistent with findings that risk perception does not alone lead to action, previous studies on risk communication indicate that simply receiving information about potential future hazards does not necessarily lead to higher preparedness (Steelman & McCaffrey, 2013). One objective of effective risk communication is to secure trust in the communicator as credibility is a key factor driving acceptance (Steelman & McCaffrey, 2013) and neglect or inaction during a cris can lead to trust erosion (OECD, 2016). Effective risk management should further work to include multiple stakeholders whereby their values and concerns are incorporated in risk management decisions, and the interactive exchange can facilitate building trust between parties (OECD, 2016; Steelman & McCaffrey, 2013). Yet another factor of effective communication is adapting the message to local contexts, preferably using sources that are knowledgeable about the local area.

Findings that people with no experience of flood damages strongly underestimate negative consequences of floods give rise to the implication that risk communication should help

citizens envision the negative emotional effects of floods (Siegrist & Gutscher, 2008). Furthermore, future risk communication should strive to be more forward-looking as current communication emphasizes known past and present hazards. Future messages should also work to inform of the changing climate as current risk communication emphasizes known past and present hazards but is not sufficiently forward-looking (OECD, 2016).

2.1.6 Advice giving

In the context of insurance-based recommendations about flood mitigation measures, advice giving represents a key mechanism through which individuals interpret risk information and form judgments about whether to adopt protective actions (Bonaccio & Dalal, 2006; Moser, 2014). Advice giving is a central mechanism through which individuals navigate complex choices under uncertainty, as it helps simplify decisions, builds confidence, and influences how people interpret what information matters. Across the advice-taking literature, advice systematically influences judgments and choices, although the magnitude of influence depends on features such as the advisor's perceived expertise, the task, and how advice is delivered (Bonaccio & Dalal, 2006; Yaniv, 2004). In consumer domains such as insurance, where many decisions are technically complex and outcomes are probabilistic, advice can also function as risk communication that translates abstract hazards into concrete protective options, thereby influencing behavioral intentions such as willingness to adopt measures or willingness to pay.

A robust finding is that even when advice is informative, decision-makers often underweight it relative to their own initial beliefs. This tendency is commonly discussed as egocentric discounting and reflects, among other mechanisms, the fact that individuals have privileged access to their own reasons but limited access to the advisor's underlying rationale (Bonaccio & Dalal, 2006; Yaniv, 2004). However, advice can still improve decision quality when it is incorporated as incremental information rather than treated as a competing position. This implies that advice changes behavior partly by altering uncertainty and the weighting of information sources, which is particularly relevant for preventative investments where outcomes are probabilistic and counterfactual (Dulleck & Kerschbamer, 2006).

Whether advice is accepted and acted upon depends strongly on the perceived credibility of the source. Classic persuasion research shows that source credibility affects message acceptance and subsequent judgments (Hovland & Weiss, 1951). More broadly, trust theory argues that perceived ability/competence, benevolence, and integrity are key antecedents of

trust and become particularly consequential when recipients face uncertainty and cannot fully verify claims (Mayer et al., 1995). This logic is amplified in "credence good" settings, where consumers cannot readily evaluate the appropriateness or effectiveness of expert recommendations even after implementation, making trust a key condition for compliance with advice (Dulleck & Kerschbamer, 2006). In service and relationship marketing, trust is therefore treated as a mechanism linking provider conduct to perceived value and subsequent exchange outcomes (Crosby et al., 1990; Sirdeshmukh et al., 2002).

Advice content also matters for behavioral uptake, particularly in risk contexts. Meta-analytic evidence supports the importance of efficacy information where coping appraisals are reliably associated with intentions and behavior across protection motivation theory studies (Floyd et al., 2000), and meta-analyses of fear-appeal/risk messages show stronger effects when messages include efficacy statements (Tannenbaum et al., 2015). More specifically, a meta-analysis focusing on efficacy information within fear appeals finds that messages exert stronger behavioral effects when they include positive response efficacy information (Bigsby & Albarracín, 2022). In insurance-related advisory contexts, these findings imply that advice should be more behaviorally consequential when it credibly communicates that the recommended RMM works (response efficacy) and aligns with homeowners' objectives (e.g., value preservation), while trust in the advisor facilitates acceptance of the recommendation when the consumer cannot independently verify its effectiveness.

2.2 Hypotheses

This study examines how insurers should design their communication to increase the willingness among homeowners to invest in RMMs. Since private adaptation can reduce losses at the source, increasing homeowners' adoption of effective measures is becoming more important as insurers face rising costs and affordability pressures, which may widen the protection gap if risks are not reduced (Climate Resilience Dialogue, 2024; EEA, 2024; Sveriges Riksbank, 2025).

However, the literature also shows that raising awareness of risk is not enough to generate private adaptation. Households may acknowledge climate risks yet still perceive personal risk as low, defer responsibility to public authorities, or avoid taking action when measures feel uncertain or burdensome (Bichard & Kazmierczak, 2012; Kunreuther, 2006).

2.2.1 Emphasizing Efficacy in insurer communication and its effect on willingness to invest

Prior research consistently shows that believing a measure *works* is a key condition for private adaptation. Response efficacy (belief that the action reduces damage) is a central driver of protective intentions and behavior, meaning that when response efficacy is low, individuals are less likely to form adaptation intentions even if they perceive the hazard as serious (Bubeck et al., 2012; Grothmann & Patt, 2005). This aligns with empirical evidence in flood contexts where willingness to invest in RMMs increases with perceptions that measures effectively reduce flood losses (Botzen et al., 2013) and with Swedish findings that doubts about measure effectiveness are a common reason for inaction (Grahn & Jaldell, 2019). Taken together, the literature implies that homeowners who perceive higher response efficacy should be more willing to invest in RMMs.

Insurers are well positioned to influence the response efficacy belief. They have technical knowledge about losses, credibility as a financially relevant actor, and direct incentives to reduce correlated catastrophe exposure that undermines insurability (Climate Resilience Dialogue, 2024; Sveriges Riksbank, 2025). More broadly, EUCRA highlights that improving consumer access to clear risk information and prevention options can raise preparedness and supports the idea that risk reduction becomes a precondition for continued insurability as climate impacts intensify (Climate Resilience Dialogue, 2024; EEA, 2024). Yet the existing risk communication literature has more often focused on engagement and attention than on how to convert engagement into concrete investment decisions. Based on the reviewed evidence, a key missing link is whether an insurer message that explicitly emphasizes *the effectiveness* of a specific measure is more likely to motivate willingness to invest than an otherwise similar message that does not contain efficacy information.

Accordingly, we test whether adding an efficacy-focused paragraph to an insurer's message increases willingness to invest in RMMs. The expected effect is that efficacy framing reduces uncertainty about "does this work?", thereby strengthening coping appraisal and making action more likely.

H1: Emphasizing the response efficacy of RMMs (i.e., that the measures are effective in reducing flood damage) leads to a higher willingness to invest.

2.2.2 Perceived self-efficacy as a mediator

Even when a measure is perceived as effective, homeowners may not invest if they do not believe they can implement or maintain it. Adaptation models emphasize self-efficacy as a

key component of coping appraisal whereby individuals are more likely to take protective action when they feel capable of carrying it out, while low self-efficacy can become a cognitive bottleneck that prevents adaptation intentions from forming (Bubeck et al., 2012; Grothmann & Patt, 2005). This is consistent with Swedish evidence where lack of knowledge/skills is frequently cited as a barrier to implementing RMMs (Grahn & Jaldell, 2019). This supports the notion of expecting higher self-efficacy to translate into higher willingness to invest.

Existing research appears to provide limited evidence on how response efficacy and self-efficacy influence each other in the risk communication domain. However, believing that the risk mitigation measure is effective should logically increase people's confidence in their own ability to successfully implement and maintain it. This increase in self-efficacy then raises their willingness to invest in the action.

H2: Self-efficacy mediates the effect of emphasized response efficacy on willingness to invest in RMMs.

2.2.3 Trust in insurer advice as a mediator

In risk communication and advice-taking, trust in the communicator is closely associated with both acceptance of information and subsequent behavioral responses, particularly under uncertainty where recipients cannot easily verify claims (Mayer et al., 1995; OECD, 2016; Steelman & McCaffrey, 2013). In the context of insurance-based adaptation advice, this resembles a credence-good setting, where homeowners may struggle to evaluate whether a recommendation is appropriate or effective even after implementation, increasing the relevance of trust (Dulleck & Kerschbamer, 2006). From one direction, higher perceived response efficacy may be associated with higher trust, as it signals that the recommended measure is technically sound and reflects the advisor's competence (Mayer et al., 1995). Risk communication research similarly suggests that messages perceived as clear and effective are more likely to be considered credible (Steelman & McCaffrey, 2013). From the other direction, higher trust is associated with greater willingness to pay, as it reduces perceived uncertainty and increases reliance on expert advice in credence contexts (Dulleck & Kerschbamer, 2006).

Taken together, this suggests that perceived response efficacy is related to willingness to invest partly through its association with trust, while trust is associated with a greater willingness to act on insurer recommendations under uncertainty.

H3: Trust in insurer advice mediates the relationship between emphasized response efficacy and willingness to invest in RMMs.

2.2.4 Expected property value increase as a mediator

Willingness to invest in flood-adaptation measures is not only associated with whether a measure is perceived to reduce damage, but also with whether it is perceived to generate private economic benefits. Adaptation investments are typically upfront and immediate, while avoided losses are uncertain and often discounted, which can be associated with lower adoption even when risks are acknowledged (Kijewski-Correa et al., 2023; Kunreuther, 2006). Prior research further suggests that for larger or more comprehensive adaptations, individuals may be more inclined to act when they associate the investment with tangible financial returns, such as higher market value or improved resale prospects (Kijewski-Correa et al., 2023). On one hand, higher perceived response efficacy may be associated with stronger expectations of property value gains. When a measure is perceived as effective in reducing damage, it may also be interpreted as protecting the home as an asset, which aligns with findings that households are more responsive to adaptation measures when they perceive clear and tangible benefits (Kijewski-Correa et al., 2023). On the other hand, higher perceived property value gains are associated with greater willingness to invest, as they make the investment appear financially justified rather than purely a cost, consistent with research showing that upfront adaptation costs are more acceptable when linked to expected economic returns (Kunreuther, 2006).

Overall, this suggests that perceived response efficacy is related to willingness to invest partly through its association with expectations of property value gains, while these value expectations are, in turn, associated with higher willingness to invest.

H4: The expectation that a RMM will increase property value mediates the relationship between emphasized response efficacy and willingness to invest in that measure.

2.2.5 Premium discount requirement as a moderator

Insurance pricing and premium discounts are also frequently discussed economic incentives that act as mechanisms to overcome financial barriers and increase adoption of RMMs (Botzen et al., 2009; Kunreuther, 2001). If a homeowner explicitly requires a premium discount to invest, their decision may be more constrained by economic conditions than by beliefs about effectiveness alone. In such cases, perceived response efficacy may translate less strongly into willingness to invest because the financial requirement acts as a binding

condition. Therefore, we expect the efficacy-willingness relationship to depend on whether the homeowner requires a premium discount.

H5: The positive relationship between emphasized response efficacy and willingness to invest in RMMs is weaker among homeowners who require a premium discount to invest (vs. those who do not).

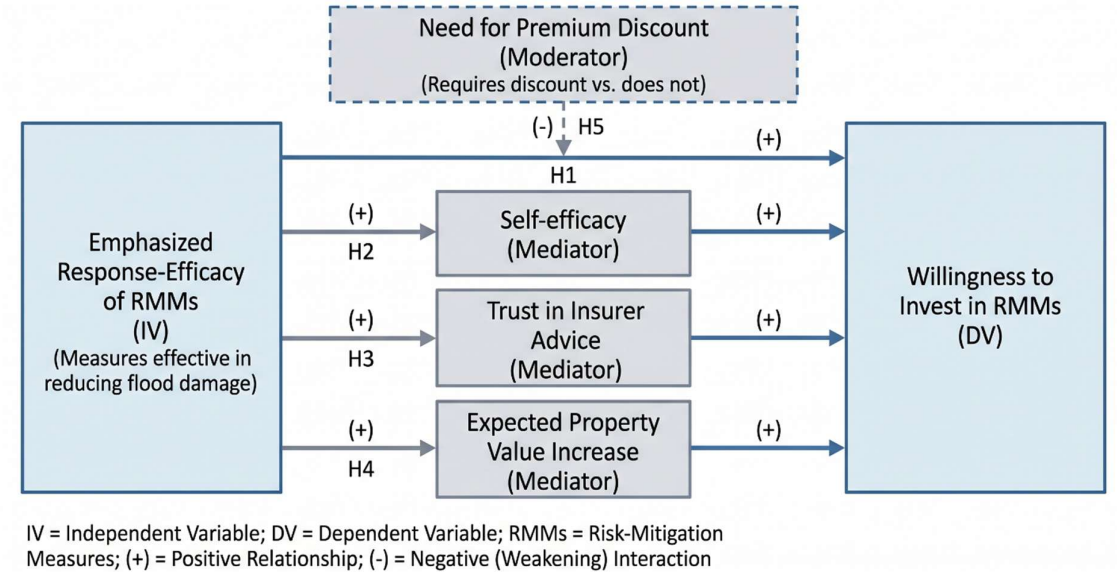


Figure 1: Conceptual framework

3. Method

3.1 Data

3.1.1 Collection method

In order to receive responses from a large and representative sample, we opted for the use of a digital survey which was distributed through the consumer panel Norstat. The panel proved to be a cost- and time-effective channel for survey distribution, and we could further leverage the existing demographic information about respondents to ensure correct fit with our survey. It would have been considerably more difficult to gather a sufficient number of respondents, or ensure relevant respondent characteristics, if the survey had been distributed via other distribution methods such as email.

The sampling method used for the survey experiment entails that observations are independent from another, not ordered in time, or otherwise sequentially dependent (e.g.,

time-series data) which makes autocorrelation less of a concern for subsequent analyses (Durbin & Watson, 1950, 1951).

A priori power analysis was conducted to determine the minimum required sample size for this between-subjects design with two independent scenario groups. Using a two-tailed test with a = .05 and 80% power, equal allocation (1:1), and a conservative small-to-medium effect size assumption (d = 0.40), the required sample was approximately 98 respondents per group (196 total) (Cohen, 1988; Faul et al., 2007; Lakens, 2022). To account for incomplete responses and data-quality exclusions, we aimed for a larger target sample size of 350 respondents. The a =.05 threshold used in the power analysis was also applied as the significance cutoff in all subsequent analyses.

The survey was launched on March 24th and concluded April 5th, which corresponds to a collection period of 13 days. In total, 420 people responded to the survey. However, 118 were excluded from analysis after not meeting inclusion criterion (i.e., not a homeowner, not accepting to answer survey in English, and not believing in a changing climate), or not answering correctly on the control questions. The final sample size for analysis was 302.

3.1.2 Target demographic and characteristics

The aim of the survey was to collect and analyze Swedish homeowners' perceptions of, and attitudes towards, risk mitigation measures. Hence, we included an exclusion criterion to sort out the individuals that did not own a single-family home or terraced house. The survey was also restricted geographically to Sweden. We did not see it necessary to limit the geographical area to coastal zones as floods can occur due to other factors such as heavy rainfall. Since we use hypothetical scenarios, the geographical location of respondents matters less than if we were asking respondents to base their intentions purely on prior personal experience.

The survey included several variables for description of the sample which included age, gender, income, and level of education. The age of the respondent demographic ranged from 20 to 83 years with an average of 49 years of age. There was roughly an equal split between genders with 161 people identifying themselves as male (53.3%) and 138 as female (45.7%), the rest preferred not to answer. Respondents reported a wide range of annual household incomes. The largest proportion (39.7%) reported earning between 500,000 and 1,000,000 SEK per year. This was followed by 23.5% earning between 1,000,000 and 2,000,000 SEK, and 14.6% earning between 250,000 and 500,000 SEK. Only 4.6% reported an income below

250,000 SEK, while 2.0% reported incomes exceeding 2,000,000 SEK. Additionally, 15.6% of respondents preferred not to disclose their income. These figures suggest that the sample is predominantly composed of middle- to upper-middle-income households.

The respondents demonstrated relatively high levels of education. “Bachelor’s / Associate degree” was the most frequently reported category, representing 34.8% of the sample. Another 33.4% reported having completed a high school diploma or equivalent. Furthermore, 23.2% held a master’s degree, while 1.3% reported having completed a doctorate. A small proportion (3.0%) had less than a high school education, and 4.3% selected “Other.” Overall, the majority of respondents possessed a post-secondary degree, indicating a well-educated participant group.

We collected certain types of personal data to describe our target participant group. However, none of the information can be used to identify any individual. Even when combining attributes such as age, gender, and income, the dataset does not allow for the identification of specific persons. To comply with GDPR requirements and uphold ethical research standards, questions about names, specific geographical locations, ethnic background, and sexual orientation were deliberately excluded. These variables would not have contributed meaningful analytical value and would have introduced unnecessary privacy risks.

3.2 Experimental design

3.2.1 Survey method

3.2.1.1 Pre-survey

Before administering the questionnaire, it is vital to understand the vocabulary of the target respondents and determining the best wording for the questions, especially as respondents cannot ask an interviewer for clarifications (Brace, 2004). Thus, a pre-test of the survey was conducted on 13 respondents who gave individual feedback on how easy it was to understand the different scenarios and questions. Based on the feedback, several questions were reformulated to prevent misinterpretation, and a picture and improved explanation of flood barriers were added to each scenario. For the sake of making the questions unambiguous, terms such as *risk mitigation measures* were changed to *flood barriers* which are easier to understand for everyday people.

3.2.1.2 Final survey design

The final survey included ten questions on attitudes, intentions and perceptions in addition to personal and control questions. The first part of the survey included two screening questions to make sure that we received results from homeowners and people comfortable answering the survey in English. To continue with the survey, respondents also had to consent to participate in the survey. They were then faced with one of the two randomized hypothetical scenarios which was followed with a question on whether they were willing to invest in the suggested measure (dependent variable). The next part consisted of the efficacy-related question (independent variable) and then questions used for moderation/mediation. Lastly, respondents answered personal questions which are used for describing the sample demographic. An optional field for freely writing any feedback or additional thoughts was also included.

3.2.2 Scenarios

To test different framings for risk communications on consumers' intentions to invest in RMMs, we created two scenarios. Each respondent was randomly assigned one out of the two possible scenarios, which strengthens causal interpretation because the framing difference is exogenous to respondent characteristics (Steiner et al., 2017; Wallander, 2009). The scenarios were presented identically by putting the respondents in the shoes as a recent buyer of a house receiving a letter from their insurance company, advising them to invest in flood barriers. This type of written "letter" format is also a common channel for risk communication in practice (OECD, 2016). The scenarios differed in their framing; one where the insurance company advocated for the measure's effectiveness in preventing damage, and another scenario where this paragraph was left out *(Appendix 1)*. This ensured two similar scenarios that tested whether how the message is framed influences how effective risk communication is.

Scenario-based survey experiments (often called vignette experiments) are appropriate for testing communication framings because they embed respondents in a concrete, realistic decision context while allowing the study to hold everything constant except the manipulated message element (Aguinis & Bradley, 2014; Steiner et al., 2017). This provides high internal validity for estimating the causal effect of efficacy framing on stated intentions, and when implemented in broader samples, can be used to make more generalizable inferences than lab-only designs (Aguinis & Bradley, 2014; Wallander, 2009). Put differently, scenarios are a

practical way to test "what would happen if an insurer communicated X versus Y" while keeping the underlying situation, measure, and decision task identical (Aguinis & Bradley, 2014; Steiner et al., 2017).

While we aimed to find results that are relevant for RMMs in general, we needed to provide a distinct and clear example of a measure which could be fitted to a residential home. We found water barriers to be a relevant measure because property-level flood resilience commonly includes resistance interventions that aim to keep floodwater out of the building through openings (e.g., doors), including flood doors and flood barriers (Environment Agency, n.d.-a; May et al., 2014.). Such measures are used as part of broader "property-level protection" approaches that can reduce flood damage and speed recovery (Environment Agency, n.d.-b). Evidence from post-event evaluations also suggests that property-level flood protection measures have performed as intended in most cases and protected against flooding in a large share of properties (May et al., 2014). At the same time, real-world effectiveness can depend on correct fit and residents' ability to deploy the measures (e.g., door barriers), which is relevant for how efficacy should be communicated in practice (May et al., 2014).

The message of the risk communication should be honest, comprehensive and motivate behavior change rather than spreading fear and powerlessness with language that is understandable to the relevant stakeholder (OECD, 2016). The advice from the insurance company in our hypothetical scenarios was therefore formulated in accordance with this proposed framework.

3.3 Variables and regression

All questions except for those related to demographics and the question *"Do you require a premium discount on your insurance in exchange for investing in these measures?" (Appendix 1)* were measured using a seven-point Likert scale. Using a seven-point Likert scale is appropriate for later regression-based analyses because (a) seven response options provide finer granularity and can better capture respondents' intended evaluations compared to coarser scales (Finstad, 2009) and (b) when Likert-type items are combined into a composite (sum/mean) scale, the resulting Likert scale variable is commonly treated as approximately interval, making means, standard deviations, and standard parametric procedures (including regression) suitable (Boone & Boone, 2012). This practice is further supported by methodological evidence that parametric methods (including

regression/correlation families) are generally robust to common assumption violations (e.g., non-normality and ordinal origins of ratings) (Norman, 2010).

The study included both single-item and multi-item measures. Single-item measures can be appropriate when constructs are concrete, easy for respondents to understand, and when survey length needs to be limited, as additional items may increase respondent burden without always improving predictive validity (Bergkvist & Rossiter, 2007; Drolet & Morrison, 2001). However, single-item measures also limit the ability to assess internal consistency and may be more vulnerable to measurement error, particularly for broader or more complex constructs (Diamantopoulos et al., 2012). Multi-item measures are therefore generally preferable for constructs that include several dimensions or are more difficult for respondents to evaluate, as they can capture different facets of the construct and allow reliability to be assessed.

3.3.1 Independent variables

The study's primary independent variable was *emphasized response efficacy*, referring to whether the insurer's risk communication explicitly emphasized the effectiveness of the recommended flood barriers. In line with the experimental vignette approach, emphasized efficacy was manipulated through two otherwise identical scenarios in which respondents were randomly assigned to receive either an insurer message without efficacy information (no-efficacy condition) *(Appendix 1)* or the same message with an added paragraph highlighting that flood barriers are effective in reducing future flood damage (emphasized-efficacy condition) *(Appendix 1)*. The scenarios were held constant in all other respects, including the described flood context, the insurer's recommendation, and the stated investment cost (SEK 5,000). This design isolates the effect of emphasized efficacy by ensuring that any observed differences in responses can be attributed to the presence versus absence of the efficacy-focused paragraph rather than to other vignette characteristics (Aguinis & Bradley, 2014; Steiner et al., 2017).

3.3.2 Dependent variable

In accordance with our hypothesis, the dependent variable used for regression relates to willingness to invest in climate adaptive measures. The question used to measure the construct was formulated as follows: "*How willing are you to invest in the flood barriers suggested by the insurance company?" (Appendix 1)*. While previous studies have tested

willingness to invest, limited prior research has been done in an insurer-advice context. The question was therefore formulated as to fit the current research topic.

3.3.3 Moderators and mediators

To capture potential mechanisms and boundary conditions related to homeowners' willingness to invest in flood barriers, the survey included measures of perceived response efficacy and self-efficacy as central coping-appraisal constructs. Response efficacy (perceived effectiveness of the measure in preventing future damage) was measured with a single item *(Appendix 1)*. Self-efficacy, reflecting respondents' perceived capability to implement and maintain the measure, was measured using three items to capture different facets of perceived ability and effort *(Appendix 1)*. The need to measure self-efficacy in multiple ways became clear during the pre-survey, where respondents found it difficult to evaluate their own role in implementation. The final scenario text also clarified that the stated investment included installation to reduce ambiguity. Two measures were reverse coded to capture the personal cost of installing and maintaining RMMS, whereas one question related to the subject's confidence in their own ability to install and maintain the RMMs. In addition, the survey measured economic incentives, perceived responsibility, and trust in insurer advice (*Appendix 1)*, as prior research suggests these factors can shape adaptation decisions and responses to risk communication. Although not central to the main manipulation, these constructs were included to enable tests of mediation and moderation, such as whether trust or expected property value gains explain associations with willingness to pay, and whether requiring a premium discount conditions the strength of key relationships.

3.3.4 Control variables

To strengthen reliability in a self-administered survey, we included comprehension/attention checks (e.g., what the survey was about) *(Appendix 1)* to detect inattentive responding that would otherwise increase measurement error and attenuate estimated effects (Berinsky et al., 2014; Oppenheimer et al., 2009). We also screened out respondents who did not believe in climate change, consistent with the logic that excluding participants who reject the study's core premise reduces construct-irrelevant variance and improves the interpretability of treatment effects in scenario-based research (Aguinis & Bradley, 2014; Steiner et al., 2017).

3.3.5 Analyses

3.3.5.1 Prepping the data

Before conducting the main analyses, the dataset was filtered to ensure data quality and internal validity. Specifically, respondents who indicated that they did not believe in climate change were excluded, as their responses would not align with the underlying assumptions of the study and could introduce systematic bias when evaluating attitudes toward climate adaptation measures. In addition, respondents who failed the control question were removed to mitigate issues related to inattentive or careless responding, which are well-documented threats in self-administered surveys (Berinsky et al., 2014; Oppenheimer et al., 2009). This filtering procedure helps improve the reliability of the data and ensures that the results more accurately reflect informed and engaged respondents, thereby strengthening the validity of subsequent analyses.

3.3.5.2 T-tests for manipulation check

Independent-samples t-tests were used primarily as a manipulation check to assess whether the condition manipulation (emphasized efficacy vs. no efficacy) produced differences in key perceptions between the two randomized groups, using a two-tailed significance level of α =.05. Given the between-subjects design, t-tests provide an appropriate method for comparing group means and evaluating whether any observed differences are unlikely to have occurred by chance (Ruxton, 2006). This served as an initial validation step before proceeding to regression-based analyses of associations among the study variables.

3.3.5.3 Regression

Regression analysis was used to empirically test relationships between key constructs and evaluate the proposed hypotheses, applying a two-tailed significance level of $\alpha = .05$. Specifically, regression enables the estimation of how independent variables such as efficacy beliefs, value perceptions, and perceived effort influence willingness to pay, while simultaneously controlling for other variables in the model. This makes it particularly suitable for survey-based research, where multiple predictors may jointly influence an outcome (Aiken et al., 1991; Wooldridge, 2010). Furthermore, regression provides a flexible framework for testing more complex relationships central to this study, such as mediation and moderation, allowing for the examination of underlying mechanisms and boundary conditions (MacKinnon et al., 2007; Preacher & Hayes, 2008). As such, regression analysis is

an appropriate and widely accepted method for analyzing behavioral responses and testing theoretically derived relationships in this context.

3.3.5.4 Mediation & Moderation

To examine whether the statistically significant associations identified in the regression analyses operated through different mechanisms, we conducted mediation analyses using the PROCESS macro for SPSS (Model 4), applying a two-tailed significance level of α = .05. Mediation tests whether a predictor X is associated with an outcome Y indirectly via a mediator M by estimating the a-path ($X \rightarrow M$), the b-path ($M \rightarrow Y$, controlling for X), and the remaining direct effect (c') of X on Y (Preacher & Hayes, 2008). Indirect effects were computed as the product ab and evaluated using 95% bootstrapped confidence intervals based on 5,000 resamples, which is recommended because the sampling distribution of indirect effects is typically non-normal (MacKinnon et al., 2004; Preacher & Hayes, 2008). In addition, using bootstrap confidence intervals reduces reliance on normal-theory standard errors and strict homoscedasticity assumptions for inference (Flachaire, 2005). In line with the study's analytical sequence, mediation models were estimated only for predictor-outcome relationships that were statistically significant in the preceding regressions, to avoid testing mechanisms for associations not supported in the data.

To test whether key predictor-outcome relationships differed depending on respondents' financial condition for investing, moderation analyses were conducted using the Process macro for SPSS (Model 1). The proposed moderator was premium discount requirement (0 = No, 1 = Yes; *"Do you require a premium discount on your insurance in exchange for investing in these measures?"*). For each focal predictor, we estimated models including the predictor, the moderator, and their interaction term (Predictor × Discount Requirement).

4. Results

4.1 Manipulation check

Using an independent-samples T-test, we examined the differences in attitudes and perceptions due to the extent efficacy of measures is communicated in the risk communication. The aim of this analysis was to check whether our manipulation of the degree to which response efficacy was communicated increased perceived response efficacy. Surprisingly, the results showed no difference between how effective the groups believed the

flood barriers to be at protecting against flood damage. Between the two groups, the results only showed significant differences in one variable. The group which received the message that elaborated on the effectiveness of the flood barriers found on average the measure to be too effortful to maintain over time more so than the other group (M = 3.59, SD = 1.59 and M = 3.20, SD = 1.47 respectively) (t(298.34) = -2.22, p = .027*) (Appendix 2)*. While not significant, respondents in the efficacy-condition also found it more effortful to implement the measures (M = 3.36, SD = 1.56) than those in the control group (M = 3.11, SD = 1.60) (t(299.84) = -1.38, p = .168). However, they also trust their own ability to protect their properties to a higher extent (M = 4.27, SD = 1.58, compared to M = 4.04, SD = 1.69) (t(298.64) = -1.24, p = .218).

Furthermore, people in the efficacy condition did not show strong beliefs in the measure contributing to an increase in the value of the property (M = 3.01, SD = 1.67), similarly to the no-efficacy group (M = 3.15, SD = 1.61) (t(299.69) = .74, p = .462). When it comes to willingness to invest in the measures presented in the scenarios, the efficacy group showed a lower intention (M = 3.78, SD = 2.12) compared to the other group (M = 4.16, SD = 2.08) (t(299.84) = 1.59, p = .113). The rest of the variables showed no significant differences between conditions either. However, the efficacy-group responded with lower means on personal responsibility (M = 5.04, SD = 1.53, compared to M = 5.12, SD = 1.62) (t(299.05) = .44, p = .662) while expecting public authorities to prevent and cover damages caused by floods to a lower degree (M = 4.41, SD = 1.56, compared to M = 4.54, SD =1.49) (t(299.33) = .72, p = .473). While the efficacy condition showed a higher level of trust in the advice (M = 4.42, SD = 1.43) than the group without emphasized efficacy (M = 4.38, SD = 1.36), this difference was not significant (t(299.15) = -.25, p = .804).

4.1.1 Limitations

The manipulation check did not prove that emphasized efficacy was higher for the group presented with the information that emphasized the effectiveness of the flood barriers. Thus, our manipulation did not work as intended. Additionally, no difference was found between groups regarding their willingness to pay for the recommended flood barriers. A plausible explanation is that the information provided may not have offered sufficiently compelling arguments to raise perceived effectiveness and, instead, it may have introduced a sense of complexity or effortfulness. Consistent with this interpretation, perceived self-efficacy was the only variable that differed significantly between the groups.

Because the manipulation was unsuccessful, we could not proceed with the planned experimental analyses. However, the survey data still offers valuable opportunities for exploratory analysis. The theoretical background identifies several expected relationships between our proposed mediators or moderators and homeowners' willingness to invest in risk-mitigation measures, and these associations can be examined independently of the experimental manipulation. To test the hypotheses, we use measured *perceived* response efficacy as a substitute for our measured *emphasized* efficacy, given that the manipulation check failed (see Table 1 for an overview of results).

4.2 Exploratory research

4.2.1 Determinants of Willingness to Pay

4.2.1.1 Premium discount requirement

An independent-samples t-test was conducted to examine whether willingness to pay (WTP) differed between respondents who require a premium discount and those who do not. The results showed a statistically significant difference between the groups, $t(271.11) = -2.161$, $p = .032$ (two-tailed) *(Appendix 3)*. Respondents who require a premium discount (M = 4.20, SD = 1.98) reported a higher willingness to pay compared to those who do not require a discount (M = 3.67, SD = 2.22). The mean difference in WTP between the groups was -0.53, with a 95% confidence interval ranging from -1.01 to -0.05 *(Appendix 3)*, indicating that the difference is statistically significant and unlikely due to chance.

4.2.1.2 Correlation analysis

While correlation does not prove causation, it can give insights into the strength and direction of the relationship between two variables. Thus, it was found appropriate to examine the correlations between our dependent variable and the main efficacy-related independent variable separately. Pearson correlations were used because the 7-point Likert measures can be treated as approximately interval and, with a sample of this size, parametric correlation tests are generally robust to moderate departures from normality (Norman, 2010). A correlation analysis between willingness to pay and perceived response efficacy showed a significant and strongly positive correlation ($r = 0.619$, $p < .001$*) (Appendix 4).* Correlation analyses were also conducted between willingness to pay and items relating to self-efficacy. A significant negative correlation between willingness to invest and how perceived effortful the measures are to maintain ($r = -.223$, $p < .001$*) (Appendix 4)* and to implement ($r = -.119$, p

= .038*)* was found *(Appendix 4)*. We did not find a significant correlation between trusting in one's own ability to ensure that the flood barriers are fitted correctly and willingness to invest (*p* = .121*) (Appendix 4)*.

4.2.1.3 Regression analysis

As previously mentioned, three questions were included relating to self-efficacy to capture a construct which can be difficult for respondents to understand in relation to flood barriers. As these questions aim to capture the same construct, these should, if appropriate, be combined into an index to avoid issues of multicollinearity during a regression analysis. A reliability analysis was conducted to test if these variables could be combined into a single variable. Perceived trust in one's own ability of ensuring that the home is sufficiently fitted with flood barriers did not prove to fit with the other two variables. How effortful the measures seemed to be *to implement* combined with *to maintain* over time showed a Cronbach's Alpha of .710 *(Appendix 5)* and the two variables were henceforth combined into a single variable for regression analyses.

An initial regression analysis was conducted by including all possible mediators as independent variables for exploratory research, which included variables on efficacy, economic incentives, personal responsibility, and trust in the advice. Overall, the model indicated a moderate level of association with the outcome, with an adjusted R-squared of .492, meaning that a substantial portion (~50.8%) of variation is not accounted for by the included variables. Still, the overall model is statistically significant (F = 42.579, $p < .001$) *(Appendix 6)*, suggesting that the set of independent variables is jointly related to the outcome. Since all variables are measured on a common 1-7 scale, unstandardized coefficients (B) are used for interpretation, as they are directly comparable across predictors.

The results show that perceived effectiveness of flood barriers has the strongest positive association (B = .540, $t = 7.83$, $p < .001$) *(Appendix 6)*, indicating that a one-unit increase in perceived effectiveness is associated with a higher willingness to invest. Similarly, expectations of increased property value are positively and significantly associated with willingness to invest (B = .393, $t = 6.15$, $p < .001$), highlighting the relevance of financial considerations. Trust in one's own ability to sufficiently implement flood barriers is negatively associated with adoption (B = -.120, $t = -2.20$, $p = .029$), suggesting that individuals who feel self-reliant may report lower willingness to invest in protective measures. In contrast, perceiving flood barriers to be too effortful to implement and maintain

is significantly negatively associated with adoption intention (B = -.296, t = -4.62, p < .001). As expected, higher trust in the advice is associated with higher willingness to invest in the measures (B = .197, t = 2.97, p = .003). Personal responsibility (B = .013, t = .223, p = .824) and expectations of government compensation (B = .050, t = .87, p = .384) are not statistically significant, indicating limited association with decision-making in this context.

Diagnostic tests suggest that the key assumptions of the regression model are reasonably satisfied. First, the Durbin–Watson statistic (1.899) *(Appendix 6)* is close to 2, indicating no serious issues of autocorrelation in the residuals. This is as expected given that the observations are assumed to be independent of another and not ordered in time. Second, there is no strong evidence of heteroscedasticity, as the residuals appear to exhibit constant variance across predicted values, supporting the assumption of homoscedasticity. Finally, multicollinearity does not appear to be a concern, as all variance inflation factor (VIF) values are low (around 1.0-1.5), well below commonly accepted thresholds. Overall, these diagnostics suggest that the model estimates are stable and not substantially affected by violations of key regression assumptions.

4.2.2 Mediation & Moderation effects

4.2.2.1 Mediation

Mediation analyses were conducted for variables that showed statistically significant relationships in the preceding exploratory regression models. Specifically, we examined whether the observed associations between predictors and willingness to pay were related to proposed mediator(s) (a- and b-paths), while also estimating the remaining direct association (c′-path). Indirect effects were evaluated using bootstrapped confidence intervals, which is standard practice given the non-normal sampling distribution of mediated effects (MacKinnon et al., 2004).

Mediation analyses were conducted using 5,000 bootstrap samples, and three out of the four models produced statistically significant indirect effects. First, the indirect association between response efficacy belief and willingness to pay through trust in insurers' advice was significant (B = .056, 95% CI [0.013, 0.112]) *(Appendix 7)*. Efficacy belief was positively associated with trust (B = .284, p < .001), and trust was positively associated with willingness to pay (B = .197, p = .006). The direct association between efficacy belief and willingness to pay remained significant (B = .786, p < .001), indicating that both direct and indirect associations are present. The indirect effect was small relative to the total association,

suggesting that efficacy belief is primarily related to willingness to pay directly, with trust representing an additional pathway.

Second, the indirect association between value perception and willingness to pay through trust in insurers' advice was also significant (B = .058, 95% CI [0.020, 0.107]) *(Appendix 7)*. Value perception was positively associated with trust (B = .191, $p < .001$), and trust was positively associated with willingness to pay (B = .303, $p < .001$). The direct association between value perception and willingness to pay remained significant (B = .644, $p < .001$), again indicating that both direct and indirect associations are present. The indirect effect accounted for a modest proportion of the total association, suggesting that value perception is mainly related to willingness to pay directly, while trust constitutes an additional, smaller pathway.

Third, the indirect association between response efficacy and willingness to pay through self-efficacy was not statistically significant (B = -.001, 95% CI [-0.022, 0.020]) *(Appendix 7)*. Response efficacy was not significantly associated with self-efficacy (B = .004, $p = .944$), while self-efficacy showed a small negative association with willingness to pay (B = -.119, $p = .042$). The direct association between response efficacy and willingness to pay remained strong and statistically significant (B = .843, $p < .001$), indicating that the overall relationship is primarily direct, with no evidence of an additional indirect association through self-efficacy.

A fourth mediation model examined whether perceived property value increase is related to the association between response efficacy beliefs and willingness to pay. The indirect effect was positive and statistically significant (B = .220, 95% CI [0.132, 0.317]) *(Appendix 7)*, indicating that efficacy beliefs are associated with willingness to pay partly through stronger expectations of property value gains. Efficacy beliefs were positively associated with perceived property value (B = .573, $p < .001$), and perceived property value was, in turn, positively associated with willingness to pay (B = .384, $p < .001$). The direct association between efficacy beliefs and willingness to pay remained significant (B = .622, $p < .001$), indicating that both direct and indirect associations are present. Compared to the previously identified mediation effects, this indirect effect is larger in magnitude, suggesting that perceived property value represents a more substantial pathway through which efficacy beliefs are related to willingness to pay.

4.2.2.2 Moderation

To assess whether the associations identified in the exploratory regression analyses varied across respondents, we tested moderation using PROCESS Model 1. Premium discount requirement (0 = No, 1 = Yes) was specified as the moderator, and separate models were estimated for each focal predictor. Each model included the focal predictor, premium discount requirement, and their interaction term (Predictor × Discount Requirement). Moderation was evaluated based on whether the interaction term significantly predicted willingness to pay.

None of the interaction terms were statistically significant, indicating that premium discount requirement did not significantly alter the relationship between any of the focal predictors and willingness to pay. For response efficacy, the interaction effect was not significant (B = -.041, p = .737, 95% CI [-.283, .200], ΔR^2 = .000). Similarly, the interaction between value perception and premium discount requirement was not significant (B = -.214, p = .085, 95% CI [-.457, .029], ΔR^2 = .007). The interaction between perceived effortfulness and premium discount requirement approached significance but remained non-significant (B = .330, p = .062, 95% CI [-.016, .676], ΔR^2 = .011). Likewise, no moderation effect was found for trust in insurer advice (B = .054, p = .745, 95% CI [-.274, .383], ΔR^2 = .000) or self-efficacy (B = -.168, p = .256, 95% CI [-.460, .123], ΔR^2 = .004).

Overall, premium discount requirement did not significantly moderate any of the examined relationships between the focal predictors and willingness to pay *(see Appendix 8 for summary)*.

Hypothesis		Results
H1	Emphasizing the response efficacy of RMMs (i.e., that the measures are effective in reducing flood damage) leads to a higher willingness to invest.	Supported*
H2	Self-efficacy mediates the effect of emphasized response efficacy on willingness to invest in risk-mitigation measures.	Not supported*
H3	Trust in insurer advice mediates the relationship between emphasized response-efficacy and willingness to invest in RMMs.	Supported*
H4	The expectation that a RMM will increase property value mediates the relationship between emphasized response-efficacy and willingness to invest in that measure.	Supported*
H5	The positive relationship between emphasized response efficacy and willingness to invest in RMMs is weaker among homeowners who require a premium discount to invest (vs. those who do not).	Not supported*

* *Note: All hypotheses were tested using perceived response efficacy instead of emphasized response efficacy*

Table 1 Summary Hypothesis Testing

5. Discussion

The aim of this study was to examine whether insurers' risk communication that emphasizes the effectiveness of a risk mitigation measure influences homeowners' willingness to invest in such measures. More specifically, homeowners who received a message highlighting the efficacy of the measure were expected to demonstrate a greater willingness to invest compared to those who received a more generic recommendation merely advising them to adopt the measure. The results did not reveal any meaningful differences between the two conditions regarding either *willingness to invest* or *perceived response efficacy*. Subsequently, we did not find support that the scenario where efficacy was emphasized increased perceived response-efficacy. Consequently, our manipulation check was deemed unsuccessful. This points towards a limitation of our study design, specifically regarding how efficacy was framed in the scenarios. However, we found that participants in the efficacy-focused group reported, on average, a higher perceived level of effort required to maintain the flood barriers over time. Thus, emphasizing the effectiveness of a protective action may inadvertently lead recipients to perceive behavior as more complex or burdensome, increasing the perceived personal cost of adoption. Taken together, these results suggest that

the efficacy paragraph may not have been sufficiently clear or distinct to alter perceived response efficacy. The absence of group differences should therefore be interpreted as a limitation of the manipulation, rather than as evidence against prior research suggesting that efficacy-based communication can encourage protective action.

As indicated in the results, the analysis shifted toward exploratory research. While we could not examine whether emphasizing efficacy leads to a higher willingness to invest in risk mitigation measures, the findings indicate that perceived response efficacy is closely associated with willingness to invest in RMMs. More specifically, response efficacy showed a strong positive correlation with willingness to invest and was the variable most strongly associated with willingness to invest, suggesting that higher perceived effectiveness of a measure is associated with greater willingness to adopt it. These patterns are consistent with prior research showing that protective action tends to be more likely when individuals perceive available measures as effective, and that low response efficacy is associated with lower levels of adaptation even when risk awareness is present (Bubeck et al., 2012; Grothmann & Patt, 2005). The findings are also in line with flood-specific research indicating that willingness to invest is positively related to perceived effectiveness of mitigation measures, as well as Swedish evidence highlighting doubts about effectiveness as a barrier to private adaptation (Botzen et al., 2013; Grahn & Jaldell, 2019).

Results showed that a higher perceived effort and cognitive cost associated with adopting flood barriers is significantly associated with a reduced willingness to invest. This finding is consistent with existing literature. Lindell and Perry (2012) argue that people form higher intentions to invest when they perceive high efficacy while believing the action to require less personal costs. These costs can include time, money, and effort and is highly relevant to consider when analyzing people's self-efficacy (Grothmann & Patt, 2005). Self-efficacy is an important component to whether people wish to adopt an action where the absence of it can lead to denial or wishful thinking, even when the risk is perceived as high (Bubeck et al., 2012; Grothmann & Patt, 2005). This is reasonable as those who perceive the measures to be too effortful and complicated to implement and maintain are less likely to want to spend the time and cognitive resources required to justify the investment. A smaller, yet statistically significant, effect was observed for trust in one's own ability to ensure that the home is adequately protected with flood barriers. The finding that a higher belief in one's own capabilities leads to a lower willingness to pay appears to be inconsistent with prior research that proposes that a higher self-efficacy should increase willingness to pay. Our results

suggest that respondents who feel more capable of managing flood protection themselves may be slightly less willing to pay for the suggested investment. One possible interpretation is that people believe they can handle protection independently or through less costly alternatives. This is in line with help-seeking evidence indicating that higher self-efficacy can be associated with reduced reliance on external support because individuals feel more empowered to manage problems on their own (Garrey et al., 2022).

Further, results did not indicate that self-efficacy (using the variable that captures belief in own capability) mediates the relationship between response efficacy and willingness to pay. Although response efficacy remained a strong and statistically significant predictor of willingness to pay, it was not associated with self-efficacy, and the indirect effect through self-efficacy was essentially zero. This suggests that homeowners' belief that flood barriers are effective at preventing damage does not necessarily make them feel more capable of implementing or maintaining the measure. Rather than operating through perceived personal capability, the association between response efficacy and willingness to pay appears to work mainly through evaluations of the measure itself: whether it is seen as effective, credible, and economically worthwhile. Conceptually, this is consistent with prior adaptation frameworks where response efficacy concerns the perceived effectiveness of the recommended action, whereas self-efficacy reflects individuals' beliefs about their own ability to perform the behavior and the personal costs associated with adopting it (Bubeck et al., 2012; Grothmann & Patt, 2005; Lindell & Perry, 2012; van Valkengoed & Steg, 2019). The small negative association between self-efficacy and willingness to pay further supports the notion that believing in your own capabilities reduces reliance on external support.

Trust in insurers' advice represents a third component that was analyzed in relation to willingness to invest in RMMs. The results indicate that trust is positively, and significantly, associated with willingness to pay. In terms of mediating effects, trust in insurers' advice constitutes a meaningful but secondary pathway linking both response efficacy beliefs and value perceptions to willingness to pay. This aligns with advice-taking research suggesting that advice shapes decisions under uncertainty partly through how individuals weigh information, with uptake depending on perceived credibility (Bonaccio & Dalal, 2006; Yaniv, 2004). In an insurance context, recommendations about loss prevention resemble a credence-good setting where homeowners cannot easily verify appropriateness or effectiveness even after implementation, which increases the importance of trust for acting on advice (Dulleck & Kerschbamer, 2006). Consistent with source credibility and trust frameworks, advice should

be more influential when the insurer is perceived as competent and trustworthy, and when motives are perceived as aligned with the customer's interest (Hovland & Weiss, 1951; Mayer et al., 1995). In this study, higher response efficacy likely signaled technical soundness, while higher expected value gains likely signaled personal benefit, and both were associated with higher trust and, in turn, higher willingness to pay (Crosby et al., 1990; Sirdeshmukh et al., 2002).

This study included measures on two differing types of financial incentives, namely house price appreciation and a discount on the insurance premium. The findings indicated a significant positive relationship between expectations of home price appreciation and willingness to invest in the RMM. Furthermore, the results show that expected property value gains represent a more substantive mechanism through which response efficacy is associated with higher willingness to pay. Homeowners who believe the measure is effective may also be more likely to interpret it as financially worthwhile, which increases willingness to invest. This pattern is consistent with adaptation research emphasizing that household investments are shaped by coping appraisals as well as perceived private economic benefits, given that adaptation costs are immediate while avoided losses are uncertain and often discounted (Grothmann & Patt, 2005; Kijewski-Correa et al., 2023).

In contrast, premium discount requirements seem to play a different role in investment decisions than first predicted. The results showed that the respondents that would require a premium discount in exchange for investing in the RMMs had selected a higher willingness to pay beforehand. This is somewhat surprising given that they reported being interested in investing despite the message not mentioning that their monetary outlay would be reciprocated by the insurance company monetarily. The results further nuance the expected role of premium discounts in homeowners' adaptation decisions. Based on prior work, premium reductions can be understood as an economic incentive that may make private risk mitigation more attractive, particularly because RMMs require upfront costs while avoided losses are uncertain and delayed (Botzen et al., 2009; Kijewski-Correa et al., 2023; Kunreuther, 2006). However, the absence of significant interaction effects suggests that requiring a premium discount did not change how response efficacy, value perceptions, trust in advice, or self-efficacy were associated with willingness to pay. This differs from the initial expectation that respondents requiring a discount would translate efficacy beliefs less strongly into investment intentions because the financial condition would act as a binding

constraint. Instead, the results indicate that the psychological and evaluative mechanisms were relatively stable across respondents, regardless of discount requirement.

One possible explanation is that premium discount requirement captures a general preference for reducing private costs, rather than a factor that changes how people translate adaptation-related beliefs into investment intentions. This interpretation is consistent with adaptation frameworks emphasizing that willingness to act depends strongly on coping appraisals, including perceived response efficacy, perceived ability, and perceived costs, rather than on financial incentives alone (Bubeck et al., 2012; Grothmann & Patt, 2005; Lindell & Perry, 2012). It is also consistent with the finding that perceived property value increase was directly and indirectly associated with willingness to pay, suggesting that homeowners may respond more strongly to broader perceived economic value than to insurance compensation specifically. Thus, while premium discounts may remain relevant for reducing adoption barriers, the present results suggest that they did not alter the relationship between adaptation-related beliefs and willingness to invest in this sample.

Overall, our findings suggest that willingness to pay is primarily driven by respondents' own evaluations of the measure's effectiveness, while trust and value expectations represent additional pathways that help explain why efficacy beliefs matter. Efficacy appears most relevant when it supports both credibility and perceived economic relevance.

5.1 Managerial implications

The findings provide several implications for how insurers and other risk communicators can encourage homeowners to invest in flood-related RMMs. Since the experimental manipulation did not significantly increase perceived response efficacy or willingness to pay, the implications should be interpreted cautiously and primarily as insights from the exploratory associations. Nevertheless, the results point to several concrete communication principles that are consistent with the theoretical framework.

The findings suggest that insurers' risk communication should move beyond generic advice to invest and instead make RMMs feel effective, credible, economically relevant, and manageable. First, communication should explain clearly how and under what conditions flood barriers reduce damage. Perceived response efficacy was the strongest predictor of willingness to pay, which supports prior research showing that protective action is more likely when homeowners believe that the measure is effective (Bubeck et al., 2012;

Grothmann & Patt, 2005; Lindell & Perry, 2012). However, the efficacy condition did not increase perceived response efficacy, suggesting that a simple statement about effectiveness is insufficient. Messages should therefore provide concrete explanations, examples, or evidence of damage reduction rather than broad claims.

Second, efficacy communication should be paired with information that reduces perceived effortfulness. The only significant difference between the conditions was that respondents in the efficacy-group perceived the measure as more effortful to maintain, and perceived effortfulness was negatively associated with willingness to pay. This indicates that emphasizing effectiveness may unintentionally make the measure appear more complex. Since coping appraisal depends not only on perceived effectiveness but also on perceived costs such as time, effort, and difficulty, communication should clarify what the homeowner actually needs to do, how installation works, and what maintenance is required (Bubeck et al., 2012; Grothmann & Patt, 2005; Lindell & Perry, 2012).

Third, communication should highlight the economic relevance of RMMs. Expected property value gains were an important pathway linking response efficacy to willingness to pay, suggesting that homeowners are more willing to invest when the measure is seen as financially worthwhile. This is consistent with research showing that adaptation investments are harder to motivate when costs are immediate while avoided losses are uncertain and delayed (Kijewski-Correa et al., 2023; Kunreuther, 2006). Messages should therefore frame RMMs not only as protection against future damage, but also to preserve the home as an asset.

Fourth, trust should be strengthened by making the basis for the advice transparent. Trust in insurer advice was a significant but secondary pathway linking both response efficacy and value perceptions to willingness to pay. This aligns with advice-taking and trust research showing that advice is more influential when the source is perceived as credible, competent, and aligned with the recipient's interests (Bonaccio & Dalal, 2006; Dulleck & Kerschbamer, 2006; Hovland & Weiss, 1951; Mayer et al., 1995; Yaniv, 2004). Insurers should therefore explain why they recommend a measure, what risk information the recommendation is based on, and how the homeowner benefits from acting on it.

Finally, premium discounts should be treated as a complementary incentive rather than the main driver of investment. Although premium reductions are discussed as a way to encourage mitigation (Botzen et al., 2009; Kunreuther, 2001), the moderation analyses showed that

discount requirement did not change the relationships between the key predictors and willingness to invest. This suggests that discounts may reduce financial barriers, but they should be combined with communication that strengthens perceived effectiveness, reduces effortfulness, builds trust, and highlights economic value.

5.2 Limitations & Future directions

A key limitation of our study design is that we tested risk communication messages through a survey where the message might not have included everything that can be relevant for a homeowner to evaluate the investment. The appropriateness of the channel can further be questioned as in practice, risk communication is often most effective when adapted to different audiences/target groups and delivered through channels suited to those audiences (e.g., campaigns using multiple channels and tailoring to target populations) (OECD, 2016). This implies that insurers would likely need to design targeted messages for different homeowner segments and use appropriate channels to ensure comprehension and actionability (OECD, 2016). Furthermore, the use of hypothetical scenarios presents another cause of limitation as respondents, while being homeowners, have not necessarily been exposed to direct flood risks in the past or reside in high-risk areas. Relatedly, the study did not collect data on respondents' prior experience with flooding or their familiarity with flood barriers specifically. This limits our ability to determine whether previous exposure to flood events or prior knowledge of the proposed RMM influenced how respondents interpreted the scenario, evaluated the effectiveness of the measure, or stated their willingness to invest. Homeowners with direct flood experience may perceive the risk as more concrete and urgent, while those familiar with flood doors may have stronger pre-existing beliefs about their effectiveness, practicality, or cost.

A further limitation is that the scenario necessarily described a flood-risk context without being tailored to each respondent's actual property or local flood history. As a result, some respondents may have received information that did not correspond to their real situation, for example by being told that nearby floods had occurred even if they did not perceive such events as relevant or accurate for their own area. This may have unintentionally triggered psychological reactance, as persuasive messages can produce resistance when recipients perceive them as inaccurate, overly directive, or as limiting their freedom to evaluate the issue independently (Dillard & Shen, 2005; Rains, 2013). Such reactance could have reduced acceptance of the insurer's advice and may partly explain why the efficacy-focused message

did not increase perceived response efficacy or willingness to invest. Future research should therefore use more localized and respondent-specific information, such as actual flood exposure, prior flood experience, and familiarity with the recommended measure, to reduce the risk that participants reject the message because it does not match their lived context.

Yet another limitation might partially explain why the additional paragraph with efficacy information did not yield a higher perceived response efficacy. As previously discussed, the condition containing additional information was associated with a significantly higher perception that the flood barriers would require more effort to maintain over time. Including additional information can thus lead to cognitive depletion where more information signals complexity and requires more cognitive effort to understand and remember. It may also lead to an argument dilution effect as presenting weaker claims alongside strong arguments may undermine the persuasiveness of the message (Obermaier & Koch, 2024). Future studies comparing several conditions could therefore keep all messages similar in length and instead alter the degree to which efficacy is emphasized.

This paper has focused on the development of messages emphasizing the effectiveness of risk mitigation measures (RMMs) and examining how this construct interacts with other factors, such as self-efficacy, trust, economic incentives, and personal responsibility. The limitations discussed previously, together with the study's relatively narrow focus on response efficacy as a component of risk communication, suggest several potential directions for future research. Future studies could, for example, control for additional constructs such as self-efficacy and economic incentives or develop communication strategies that integrate multiple dimensions simultaneously. This would enable researchers to examine how these factors interact and whether combinations of different communication elements create synergistic effects that influence homeowners' willingness to invest in risk mitigation measures. Lastly, our research highlights the need to further develop messages that emphasize response efficacy. Future research could examine what constitutes an impactful message and what components meaningfully contribute to increased perceived effectiveness of RMMs. Future studies would preferably be done in cooperation with insurers as they can craft messages that are suitable for their customers and deliver advice through channels that are appropriate in practice.

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AI Disclosure

AI supported several stages of the writing process to improve clarity, structure and wording. Firstly, AI tools were used to identify and gather initial sources, including SSE Library's research assistant and Scispace. Furthermore, Zotero has been used to generate citations and create a reference list. Secondly, ChatGPT assisted in producing early drafts, offering suggested structures that improved readability and overall consistency. Segments of texts have also been revised in accordance with AI suggestions regarding wording and clarity. Lastly, the conceptual model was created using generative AI, with our hypotheses as input. The main risk identified when using AI tools were hallucinations that could occur when the AI wrote the initial drafts or came with suggestions on content and structure. To mitigate this, we ensured that all statements were rewritten in accordance with relevant literature and served our purpose for this thesis.

7. Appendix

7.1 Survey design

Appendix 1: Online Survey

	Survey Item	List of responses
Introduction & consent		
Q1	Denna gang är undersökningen på engelska. Är du bekväm med att svara på frågorna på engelska? (Are you comfortable answering questions in English?)	(1)Ja, det går bra (Yes), (2)Nej, jag avstår från att delta i undersökningen (No)
Q2	Do you currently own a single family home (or terraced house)?	(1)Yes, (2)No, (3)Prefer not to say / Not applicable
Q3	Information about survey and consent	(1)I have taken part of the information provided above and consent to take part in this study
Conditions: each respondent is assigned to either no-efficacy condition (Q4_1) or efficacy condition (Q4_2).		
Q4_1	You have recently bought a single-family house. When signing home insurance, the insurance company tells you: "Welcome to your new home. Last year, major floods damaged several residential properties in Sweden, including in your local area. To reduce the risk of future flood damage to your basement and house foundation, we recommend that you install flood barriers. The investment would cost SEK 5,000, which includes materials and installation."	

	Flood barriers can be fitted to doors, windows and across driveways. Below is an example of how a barrier might look: <image> How willing are you to invest in the flood barriers suggested by the insurance company?	1-7 Likert scale where 1=Highly unlikely & 7=Highly likely
Q4_2	You have recently bought a single-family house. When signing home insurance, the insurance company tells you: "Welcome to your new home. Last year, major floods damaged several residential properties in Sweden, including in your local area. To reduce the risk of future flood damage to your basement and house foundation, we recommend that you install flood barriers. The investment would cost SEK 5,000 which includes materials and installation. Flood barriers can substantially reduce how much water enters a house and help protect the house's foundation during heavy rainfall or flooding. When correctly installed and maintained, homes with flood barriers typically experience noticeably less water intrusion and far less damage than comparable homes without barriers, where water is more likely to flow in freely and cause more extensive repairs. While no measure can fully eliminate flood risk, flood barriers are often an effective first line of defense and can meaningfully reduce the expected severity of damage." Flood barriers can be fitted to doors, windows and across	

	driveways. Below is an example of how a barrier might look: <image> How willing are you to invest in the flood barriers suggested by the insurance company?	1-7 Likert scale where 1=Highly unlikely & 7=Highly likely
Follow-up questions		
Q5	How effective do you think upgrading your home with the suggested flood barriers is to prevent future damage to your home?	1-7 Likert scale where 1 = Very ineffective & 7 = Very effective
Q6	To what extent do you think upgrading your home with flood barriers would increase the property value of your new home?	1-7 Likert scale where 1 = No increase in value & 7 = A very large increase in value
Q7	Please state as whether you agree or disagree with the following statement: "I trust my own ability of ensuring that my property is sufficiently fitted with flood barriers"	1-7 Likert scale where 1 = Fully disagree & 7 = Fully agree
Q8	Please state as whether you agree or disagree with the following statement: "Flood barriers are too complicated and effortful for me to implement"	1-7 Likert scale where 1 = Fully disagree & 7 = Fully agree
Q9	Please state as whether you agree or disagree with the following statement: "Flood protection measures are too effortful for me to maintain over time"	1-7 Likert scale where 1 = Fully disagree & 7 = Fully agree
Q10	Do you require a premium discount on your insurance in exchange for investing in these measures?	0 = No 1 = Yes
Q11	How personally responsible do you feel for ensuring that your properties are protected from floods?	1-7 Likert scale where 1 = Not at all & 7 = Fully personally responsible

Q12	To what extent do you expect public authorities to prevent and cover damages caused by floods?	1-7 Likert scale where 1 = To no extent & 7 = To a very high extent
Q13	To what extent do you trust the advice given by the insurance company?	1-7 Likert scale where 1 = I do not trust the advice from the insurance companies at all & 7 = I have full trust in advice from insurance companies
Personal questions		
Q14	What is your age?	Text entry
Q15	Gender identity	1=Male, 2=Female, 3=Non-binary / third gender, 4=Prefer not to say
Q16	What is your annual household income in SEK?	1=Less than 250,000, 2=250,000 – 500,000, 3=500,000 – 1,000,000, 4=1,000,000 – 2,000,000, 5=More than 2,000,000, 6=Prefer not to say
Q17	Do you believe in climate change?	1=Yes, 2=Maybe, 3=No
Q18	What is the highest degree or level of school you have completed?	1=Less than a high school diploma, 2=High school diploma or equivalent, 3=Bachelor's / Associate degree, 4=Master's degree,

		5=Doctorate, 6=Other(text entry)
Q19	What has this questionnaire been about?	1=Ice cream flavors, 2=Travel insurance, 3=Flood barrier investment, 4=Retailers' AI adoption
Q20	Please write any additional thoughts you have on the topic	Text entry

7.2 Preliminary Analyses

7.2.1 Independent-samples t-test

Appendix 2: Manipulation check

	Condition	Mean	Std. Deviation	Std. Error mean
WTP	*No efficacy*	*4.1589*	*2.07555*	*.16891*
	Efficacy	*3.7748*	*2.12343*	*.17280*
Perceived response efficacy	*No efficacy*	*3.68*	*1.602*	*.130*
	Efficacy	*3.68*	*1.498*	*.122*
Expected property value increase	*No efficacy*	*3.15*	*1.614*	*.131*
	Efficacy	*3.01*	*1.667*	*.136*
Trust in own capability	*No efficacy*	*4.04*	*1.685*	*.137*
	Efficacy	*4.27*	*1.575*	*.128*
Perceived Effort to implement	*No efficacy*	*3.11*	*1.601*	*.130*
	Efficacy	*3.36*	*1.564*	*.127*
Perceived Effort to maintain	*No efficacy*	*3.20*	*1.474*	*.120*
	Efficacy	*3.59*	*1.589*	*.129*
Personal responsibility	*No efficacy*	*5.12*	*1.620*	*.132*
	Efficacy	*5.04*	*1.531*	*.125*

Public authority expectation	*No efficacy*	*4.54*	*1.487*	*.121*
	Efficacy	*4.41*	*1.559*	*.127*
Trust in advice	*No efficacy*	*4.38*	*1.356*	*.110*
	Efficacy	*4.42*	*1.430*	*.116*

	t	df	Two-sided p	Mean difference
WTP	*1.590*	*299.844*	*.113*	*.38411*
Perceived response efficacy	*-.037*	*298.660*	*.970*	*-.007*
Expected property value increase	*.736*	*299.685*	*.462*	*.139*
Trust in own capability	*-1.235*	*298.637*	*.218*	*-.232*
Perceived Effort to implement	*-1.382*	*299.835*	*.168*	*-.252*
Perceived Effort to maintain	*-2.215*	*298.343*	*.027*	*-.391*
Personal responsibility	*.438*	*299.047*	*.662*	*.079*
Public authority expectation	*.718*	*299.328*	*.473*	*.126*
Trust in advise	*-.248*	*299.145*	*.804*	*-.040*

Note: equal variances not assumed

Appendix 3: Premium discount and Willingness to pay (WTP)

	Premium discount required	N	Mean	Std. Deviation	Std. Error mean
WTP	*No*	*135*	*3.6741*	*2.22211*	*.19125*
	Yes	*167*	*4.2036*	*1.98044*	*.15325*

	t	df	Two-sided p	Mean difference	Lower	Upper
WTP	*-2.161*	*271.105*	*.032*	*-.52952*	*-1.01201*	*-.04703*

Note: equal variances not assumed

7.2.2 Correlations

Appendix 4: Correlations with Willingness to invest

Variable (correlation with WTP)	Pearson Correlation	Significance (p)
Response efficacy	*.619*	*<.001*
Effortfulness to implement	*-.119*	*.038*
Effortfulness to maintain	*-.223*	*<.001*
Trust in own capability	*-.089*	*.121*

7.2.3 Reliability statistics

Appendix 5: Self-efficacy index

Cronbach's Alpha	Nr. of items
.710	2

7.3 Regression Analyses

Appendix 6: Regression: willingness to pay

Model summary

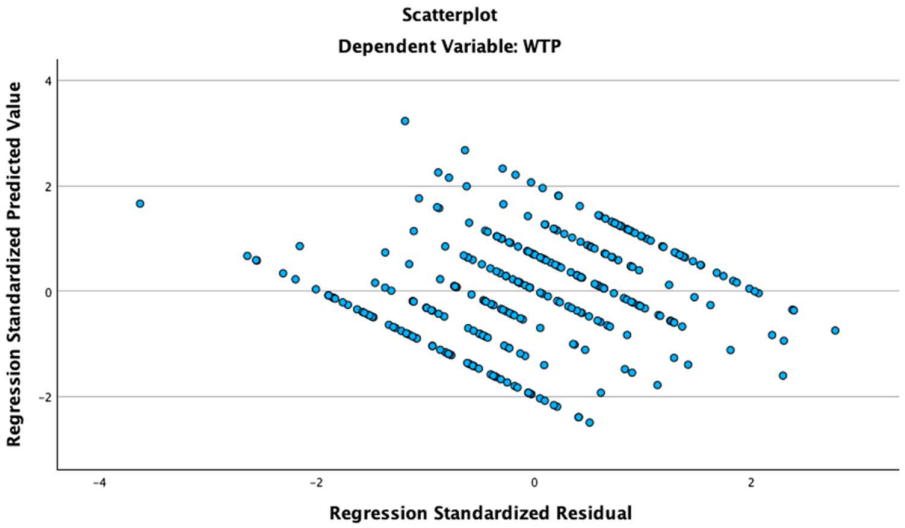
R-Squared	Adjusted R-squared	Std. Error of the Estimate	Durbin-Watson
.503	.492	1.50088	1.899

Anova

	Sum of Squares	df	Mean Square	F	Sig.
Regression	671.396	7	95.914	42.579	<.001
Residual	662.273	294	2.253		
Total	1333.669	301			

Coefficients

	Unstandardized B	Coefficients Std. Error	t	Sig.	VIF
(Constant)	*1.092*	*.566*	*1.928*	*.055*	
Perceived response efficacy	*.540*	*.069*	*7.833*	*<.001*	*1.525*
Expected property value increase	*.393*	*.064*	*6.154*	*<.001*	*1.462*
Trust in own capability	*-.120*	*.055*	*-2.196*	*.029*	*1.061*
Too effortful	*-.296*	*.064*	*-4.619*	*<.001*	*1.038*
Personal responsibility	*.013*	*.058*	*.223*	*.824*	*1.108*
Public authority expectation	*.050*	*.058*	*.871*	*.384*	*1.036*
Trust in advice	*.197*	*.066*	*2.967*	*.003*	*1.138*



7.4 Mediation Analyses

Appendix 7: Mediation results summarized

Predictor (X)	Mediator (M)	Outcome (Y)	X → M (a-path)	M → Y (b-path)	Direct effect (c′)	Indirect effect	Result
Response efficacy	Trust in insurer advice	WTP	B = .284, p < .001	B = .197, p = .006	B = .786, p < .001	B = .056, 95% CI [.013, .112]	Significant partial mediation
Value perception	Trust in insurer advice	WTP	B = .191, p < .001	B = .303, p < .001	B = .644, p < .001	B = .058, 95% CI [.020, .107]	Significant partial mediation
Response efficacy	Self-efficacy	WTP	B = .004, p = .944	B = −.119, p = .042	B = .843, p < .001	B = −.001, 95% CI [−.022, .020]	No mediation
Response efficacy	Expected property value increase	WTP	B = .573, p < .001	B = .384, p < .001	B = .622, p < .001	B = .220, 95% CI [.132, .317]	Significant partial mediation

Note. WTP = willingness to pay. Coefficients are unstandardized. Indirect effects were tested using 5,000 bootstrap samples and 95% percentile bootstrap confidence intervals. Mediation is considered significant when the confidence interval for the indirect effect does not include zero.

7.5 Moderation Analyses

Appendix 8: Moderation results summarized

Focal predictor (X)	Moderator (W)	Outcome (Y)	Interaction term	B	SE	t	p	95% CI	R^2 change	Result
Response efficacy	Premium discount requirement	WTP	Response efficacy × Discount	−.041	.123	−.337	.737	[−.283, .200]	.000	No moderation
Value perception	Premium discount requirement	WTP	Value perception × Discount	−.214	.124	−1.731	.085	[−.457, .029]	.007	No moderation
Perceived effortfulness	Premium discount requirement	WTP	Effortfulness × Discount	.330	.176	1.876	.062	[−.016, .676]	.011	No moderation
Trust in insurer advice	Premium discount requirement	WTP	Trust × Discount	.054	.167	.326	.745	[−.274, .383]	.000	No moderation
Self-efficacy	Premium discount requirement	WTP	Self-efficacy × Discount	−.168	.148	−1.138	.256	[−.460, .123]	.004	No moderation

Note. WTP = willingness to pay. Coefficients are unstandardized. The moderator was premium discount requirement (0 = No, 1 = Yes). All focal predictors and the moderator were mean-centered prior to analysis. Moderation was evaluated based on the interaction term between each focal predictor and premium discount requirement. None of the interaction terms were statistically significant at $p < .05$.