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What explains the disaster preparedness of micro-enterprises?

Examining socio-psychological characteristics and information provision

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Abstract: Worldwide, enterprises are hit by disasters such as cyclones and floods. Despite being impacted negatively, most enterprises do not prepare for future disasters. This study aims at understanding the determinants of enterprises' disaster preparedness. It first examines whether specific socio-psychological characteristics of entrepreneurs are associated with their enterprises' disaster preparedness. The second step includes an experiment providing enterprises with information about six specific and easy-to-implement measures of disaster preparedness. This experiment aims to understand if better information increases entrepreneurs' attitudes towards, and de facto, disaster preparedness. For this purpose, we use a panel dataset of mostly informal Mozambican micro-enterprises from 2022 and run standard fixed effects regressions and randomized controlled trial impact evaluations. First, we find that knowledge about climate change, descriptive norms, and egoistic values are associated with the disaster preparedness of enterprises. Second, providing information about disaster preparedness measures neither changes attitudes towards nor de facto disaster preparedness.

Key words: disaster preparedness, firms, informality, information, cyclone

JEL classification: D22, D91, O14, Q54

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1 Introduction

Mozambique belongs to the group of ten countries in the world with the highest disaster risk (Bündnis Entwicklung Hilft and Institute of International Law of Peace and Armed Conflict 2022). Micro-enterprises (0–9 employees) are particularly exposed to disasters but are poorly prepared to cope with and recover from them. Ensuring their survival is essential, as micro-enterprises employ about 90 per cent of the working population in low- and middle-income countries (ILO 2019). As such, they are often the only source of income for local communities—that is, they sustain livelihoods—and, therefore, the recovery of micro-enterprises after disasters matters for community recovery. To better understand enterprises' disaster preparedness, this paper sets out to examine the socio-psychological characteristics associated with enterprises' disaster preparedness. Second, it investigates whether providing information about specific preparedness measures improves micro-enterprises' disaster preparedness.

Research on disaster preparedness of micro-enterprises is scant (Howe 2011; Skouloudis et al. 2023; Veeravalli et al. 2022). While it is understood that most enterprises do not apply any or only a few preparedness measures (Egbelakin et al. 2016; Howe 2011; Leitold et al. 2021), we know less about the reasons for this inaction. Empirical work shows that one of the significant determinants of disaster preparedness is risk perception (Abbas et al. 2022; Hashim et al. 2021; Kurata et al. 2022; Li et al. 2023; Veeravalli et al. 2022). Using risk perception as an explanatory variable of disaster preparedness would, therefore, not reveal new findings. Understanding why business owners perceive risks differently and how this affects disaster preparedness remains a research gap (Harries et al. 2018). Instead of taking one risk-perception measure, we use four socio-psychological characteristics that are associated with individuals' climate change risk perceptions (van der Linden 2015; Xie et al. 2019). We examine whether and how these experiential, socio-cultural, cognitive, and socio-demographic determinants of risk perception are related to firms' disaster preparedness.

From previous empirical work, it is clear that information related to climate change and adaptation can potentially increase people's disaster preparedness (Allaire 2016; Kurata et al. 2022; Ong et al. 2023). This information should not only inform about the risks people face, but also explain measures that can be taken to prepare adequately for disasters (Howe 2011). We therefore test in a second step if providing information about easy-to-implement disaster preparedness measures affects firms' attitudes towards, and de facto implementation of, disaster preparedness measures.

The study contributes to the literature on the determinants of disaster preparedness, and the preparedness of firms in particular (Bollettino et al. 2020; Hashim et al. 2021; Howe 2011; Kurata et al. 2022; Ng 2022; Ong et al. 2023). The results might be applicable to households in developing countries because many micro-enterprises operate from their own households. In addition, we contribute to the scant literature about how to communicate about climate change, and disasters especially, to affect attitudes and behaviour (Allaire 2016; Bayes et al. 2023). In particular, this is a reply to the call to include those populations that are and will be most strongly affected by climate change in the future. So far, the academic literature on climate change messaging has focused on high-income and elite audiences (Bayes et al. 2023).

We find that climate change knowledge, personal norms, and values are the characteristics that are most strongly associated with firms' disaster preparedness. Specifically, knowledge about the causes of climate change, descriptive norms (i.e. the extent to which a firm owner thinks other firm owners are acting to reduce disaster risk), and egoistic values (i.e. pursuing self-serving activities) are positively associated with disaster preparedness. These associations are mediated by firm owners' climate change risk perceptions. Providing information about possible disaster preparedness measures does not translate into disaster preparedness of firms. We suggest that future information campaigns should influence firm

owners' descriptive norms (i.e. their beliefs that other firm owners are preparing for disasters), as well as their knowledge about climate change to increase disaster preparedness.

2 Literature

In low-income countries such as Mozambique, micro- and small enterprises are vital to livelihoods. Micro- and small enterprises provide more employment than large enterprises, employing 90 per cent of the working population in low- and middle-income countries (ILO 2019). Despite their importance, most micro-enterprises operate under highly challenging conditions. Many micro-enterprises are credit-constrained, their owners have low educational levels, and demand for their products is irregular (Barletta et al. 2022; Berkel et al. 2017; IIM 2012). One of the many challenges micro-enterprises are exposed to is weather-related disasters. The frequency and intensity of disasters are increasing due to climate change (Arias et al. 2021). Hazard-related disasters can wipe out recent accomplishments and long-term growth and stability (Berkel et al. 2021; Coffman and Noy 2012). To avoid being trapped in poverty in the long term, enterprises must prepare for disasters.

Firms' disaster preparedness level is usually measured based on a list of activities conducted to mitigate disaster events (Skouloudis et al. 2023). Yet, the determinants of firms' disaster preparedness are not fully understood. We also know that informing people about the likely risks of disasters does not automatically translate into preparation behaviour (Paton 2019). Further, most studies on firms' disaster preparedness are qualitative and, thus, cannot be used to draw causal conclusions. Broadly, they find that firms do not sufficiently prepare for disasters for various structural and individual reasons, and some are even reluctant to prepare (Bollettino et al. 2020; Howe 2011; Josephson et al. 2017; Skouloudis et al. 2023; Veeravalli et al. 2022).

Research on the determinants of disaster preparedness is in the early stages. An essential determinant of disaster preparedness that has been identified is the individual's risk perception (Hashim et al. 2021; Howe 2011; Ng 2022). Thus, firm owners who perceive a higher disaster risk should, at least theoretically, prepare more for disasters. The academic literature has examined the determinants of individuals' risk perception, and highlights four main predictors of risk perception: (1) socio-demographic; (2) cognitive; (3) experiential; and (4) socio-cultural. In studies on the UK and Australia, these four predictors explain 68 per cent of the variance in risk perception (van der Linden 2015; Xie et al. 2019). In Appendix Table A18 we show that these predictors are also relevant for Mozambique, albeit to a lesser extent, in that they explain about 50 per cent of the variance in risk perceptions of firm owners. In this study, we control for the determinants of risk perception but take disaster preparedness instead of risk perception as the outcome. Further, we control for firm and time fixed effects to obtain results as compared to previous studies examining these four determinants of risk perception.

Our socio-demographic predictor is entrepreneurial orientation. We are the first to include entrepreneurial orientation; previous studies focused on individuals more broadly instead of firm owners and managers. Adding firm-specific characteristics to the analysis is essential, as firm owners and managers differ from average individuals. The cognitive predictors include objective knowledge about climate change. Objective knowledge was shown to be valid in various cultural contexts (Shi et al. 2016) and associated with risk perception. De facto knowledge about climate change appears to be a better determinant of risk perception than subjective, self-reported knowledge about climate change (van der Linden 2015). We measure three types of objective knowledge: (1) the causes and (2) consequences of climate change, and (3) physical knowledge related to weather shocks and climate change.

One of the statements to measure firm owners' knowledge about the causes of climate change is 'Climate change is mainly caused by human activity.' The interviewee has to select between 'Correct', 'Incorrect',

and 'Don't know'. To measure physical knowledge, we asked, among other questions, whether 'At the same quantity, CO2 is more harmful to the environment than methane?'. Lastly, to measure knowledge of the consequences of climate change, statements such as 'For the upcoming decades, scientists expect the climate to change uniformly around the entire world' were used.

Experiential predictors involve affect and personal experiences with extreme weather. Affect is 'the extent to which [firm owners] view extreme weather as unpleasant, unfavorable, and negative' (Xie et al. 2019). Multiple studies find affect to be one of the main predictors of climate change perception and action (Brosch 2021). If people's emotions are triggered, they are more likely to change their attitudes and behaviour. Personal experience indicates whether a firm owner has experienced any extreme weather events in their city within the last five years. Affect and personal experience are associated with risk perception (van der Linden 2015; Xie et al. 2019).

Socio-cultural predictors include firm owners' norms related to extreme weather and more general personal values that matter for an individual's worldview in a Western context. Descriptive norms refer to the degree to which others (in our case, other business owners) are acting to reduce the risk of extreme weather. Prescriptive norms measure the degree to which a firm owner feels socially pressured to view extreme weather as a risk that requires action. Descriptive and prescriptive norms were found to be associated with risk perception (van der Linden 2015: 116).

Value orientations capture the effects of broader cultural values. We assess three value orientations: biospheric (respecting the environment), socio-altruistic (advocating for social justice), and egoistic (pursuing self-serving activities) that were shown to be significantly associated with risk perceptions in previous studies (van der Linden 2015; Xie et al. 2019).

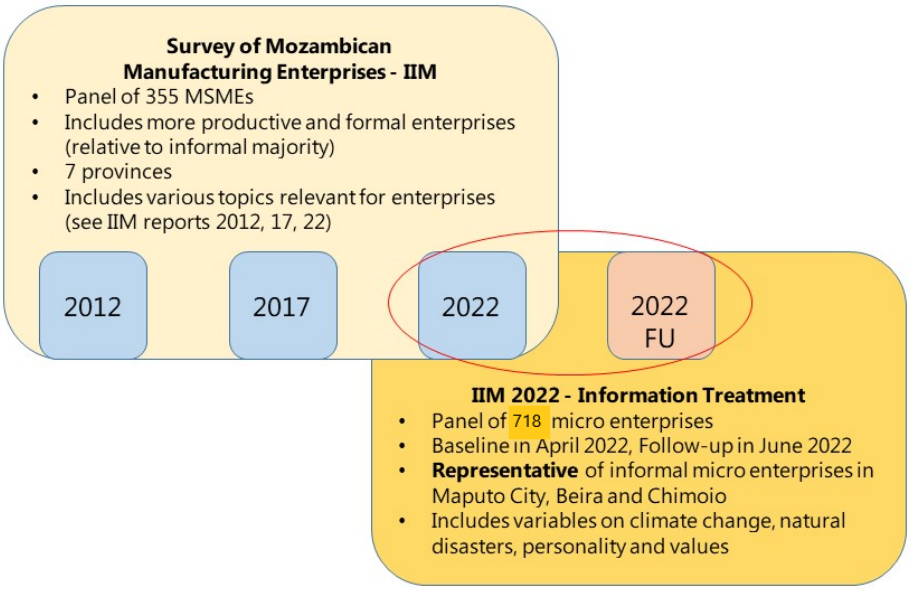
There is an evolving literature about information campaigns and which types of messages can affect people's attitudes and behaviours towards climate change. Various studies have tested whether a message stating the scientific consensus about climate change can change people's beliefs about climate change. Some obtain positive effects, while others even obtain negative, 'backfire' effects (i.e. causing people who are sceptical about climate change to become even more doubtful) (Bayes et al. 2023). The provision of information about easy-to-accomplish behavioural actions can have positive effects on factual behavioural change. For example, providing individuals with information about climate change mitigation actions can, under certain conditions, lead to de facto mitigation behaviour (Andrews et al. 2022; Leeffers 2023). More knowledge about which type of information affects disaster preparedness is necessary. Positive framing of messages and people's perceptions about other people's beliefs appears to be crucial to positively affect attitudes and behaviour. At the same time, fear-based messages can also have a positive effect on adaptation intentions (Brosch 2021). The overall conclusion of these studies is that the timing, context, and variations in messaging are essential for the impact that climate change and disaster messages have, and that we do not have sufficient knowledge about the effectiveness of variations in messaging (Bayes et al. 2023). The debate about climate change communication has mostly occurred in Western countries and related to elite populations. It is important to study sub-populations that are most vulnerable to climate change to think about how adaptation to climate change can be encouraged (Bayes et al. 2023).

3 Data

The data used in this study include all micro-enterprises that were interviewed through the Survey of Mozambican Manufacturing Firms (Inquérito às indústrias manufactureiras, or IIM) in 2022 (Barletta et al. 2022). The 2022 baseline round was collected in April 2022. While being the baseline round for this information provision experiment, it also serves as the third round of the IIM (previous rounds

took place in 2012 and 2017 (Berkel et al. 2017; IIM 2012)). We collected the follow-up data of the information provision experiment through phone interviews in June 2022. This study only includes the 2022 survey rounds because the 2012 and 2017 IIM rounds do not have the variables used here. In sum, this study uses panel data of 718 micro-enterprises interviewed in two survey rounds (baseline and follow-up in 2022). Figure 1 gives an overview of the dataset and survey rounds, and Table 1 illustrates the main firm and owner characteristics at baseline.

Figure 1: IIM 2022: information treatment



Source: authors' illustration.

Similar to Jolevski and Ayana Aga (2019), we used a stratified adaptive cluster sampling approach (Thompson 1990, 1991). First, we divided the areas for examination (i.e. Maputo City, Beira, and Chimoio) into squares of 115×115 m (see Figure 2 for the grid we put onto Beira). Next, we randomly selected 200 squares in each city. To account for the uneven population density across the area, we weighted the random draw of cells by information on the thickness of structures in each cell, following Malmgren-Hansen et al. (2020). Enumerators located all micro-businesses that operated in the selected squares. When the enumerators found one or more firms in a square, they also inspected the neighbouring squares (i.e. the squares north, south, east, and west) of the original square) for enterprises. As a result, we created a dataset including 581 firms, representative of micro-enterprises in Maputo City, Beira, and Chimoio. In addition, we re-interviewed 137 micro-enterprises from our previous IIM surveys (Barletta et al. 2022; IIM 2012) that are not representative of micro-enterprises. They are part of more productive and formal micro-enterprises as they were originally sampled from government lists in 7 of Mozambique's 11 provinces.[1]

This study only gives a short-term evaluation of the impact of providing information on firms' disaster preparedness. Mid- and longer-term impacts might be different. Moreover, the baseline survey was conducted in person, whereas the follow-up happened over the phone. Firm owners' responses might be different over the phone than in person, and we indeed see that the average attitudes towards, and practices of, disaster preparedness measures are significantly lower in the follow-up than in the baseline survey.

[1] The seven provinces included in the IIM dataset are Maputo City, Maputo Province, Gaza, Sofala, Manica, Nampula, and Tete.

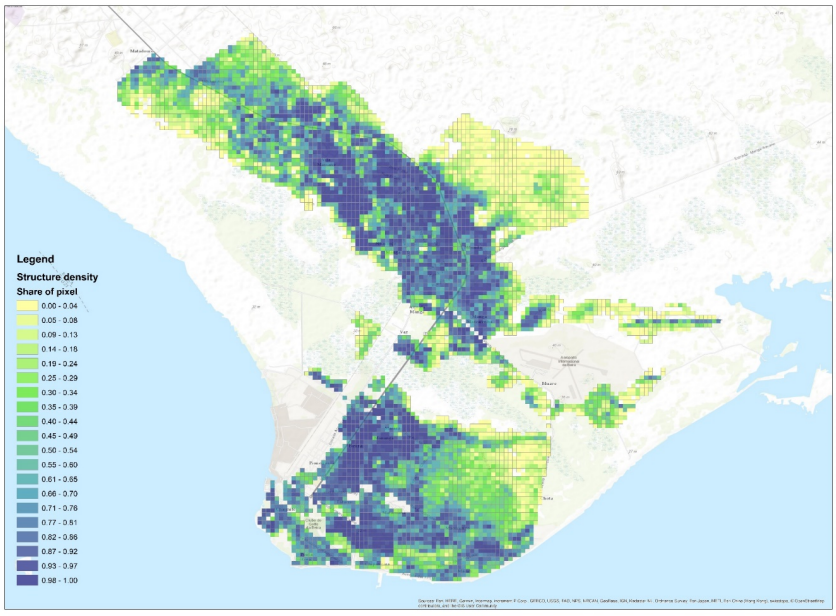
Table 1: Summary statistics of firm and owner characteristics at baseline

	All	Treated	Control
Province			
Maputo	0.376	0.360	0.388
Gaza	0.046	0.037	0.053
Sofala	0.260	0.263	0.258
Manica	0.234	0.253	0.220
Nampula	0.043	0.030	0.053
Tete	0.040	0.057	0.029*
Female	0.123	0.123	0.122
Sectors			
Food processor	0.128	0.133	0.124
Tailor	0.201	0.233	0.177*
Carpenter	0.325	0.297	0.344
Printing	0.024	0.017	0.029
Chemicals	0.004	0.003	0.005
Brickmaker	0.068	0.043	0.086**
Blacksmith	0.182	0.223	0.153**
High tech	0.001	0.003	0.000
Other	0.067	0.047	0.081***
Firm size	3.380	3.100	3.581***
Formality indicators			
Municipality	0.422	0.327	0.490***
One-stop shop (BAÚ)	0.178	0.160	0.191
Tax payer	0.221	0.193	0.242
Social security (INSS)	0.028	0.142	0.170
Risk perception			
Climate change risk perception	45.077	45.110	45.053
Cyclone risk perception	45.939	45.837	45.012
Flood risk perception	45.506	45.373	45.600
Number of firms	718	300	418

Note: mean estimates. ***Significance of t-tests between treatment and control group at $p<0.01$, ** $p<0.05$, * $p<0.1$ level. The specific survey questions are further outlined in Appendix Tables A6 and A7.

Source: authors' calculations based on MSMC data.

Figure 2: Beira decomposed into squares with colours indicating structure density



Source: authors' illustration using QGIS (version 3.2), shapefile created using 'fishnet' in ArcMap.

At the end of the baseline interview, we provided more than 300 enterprises (treatment group) with a printed leaflet including the four images illustrated in Figure 3. Enumerators handed over the leaflet and made sure that the interviewees studied the images carefully. In addition, the leaflet included the following introductory message: 'Protect your enterprise of the impact of cyclones and floods. The following images show protection measures that your enterprise can use. The measures show how to prepare and protect your enterprise for cyclones and floods. Please read the explanations in the following pictures.' The first two images show four preparation measures that enterprises can use to protect themselves from strong winds or cyclones. The remaining more than 418 enterprises (control group) did not receive any information. The images were elaborated by UN-HABITAT and the Mozambican National Institute for Disaster Management. They were not elaborated for the sake of this experiment, but had been distributed previously all over Mozambique. Approximately half of the firms self-reported to have seen the pictures in the past (i.e. they did not see the images for the first time when we provided them with the leaflet).

The four images include seven protection measures, and we asked the enterprises about six of them. The two images in the bottom illustrate measures that firms (and households) can use to prepare themselves for strong winds and cyclones. The first picture shows (1) strengthened windows with sheet covers or plywood held by wooden or metallic battens and (2) strengthened doors with wooden or metallic crossbars fixed to the wall. The second picture illustrates (1) a roof strengthened between the beams with metallic strings or straps and (2) a roof strengthened with more nails. The bottom pictures illustrate measures that firms can use to prepare themselves for floods. The third picture shows the elevation of objects. The fourth picture illustrates a measure that firms can take in collaboration with their neighbourhood: removing trash from drainage channels. We did not ask firms about the second measure shown in the fourth picture (i.e. the signalling of garbage holes and uncovered (pot)holes). In addition to the six preparation measures that we asked the firms about and that were illustrated by the images, we asked about four additional measures that were not shown in any images. Thus, in total, we asked firms about ten preparation measures, of which six were shown in images and four were not.

Table 2 summarizes the main outcome variables: ten measures that represent firms' disaster preparedness. At baseline, there were no statistically significant differences between the treatment (firms that obtained information) and the control group regarding the willingness, effectiveness, and usage of the ten measures. The measure that firms are most willing to apply and in practice do apply most is strengthening the roof with more nails (DP4). On a willingness scale from 1 (fully unwilling) to 5 (highly willing), micro-enterprises have a willingness of slightly higher than 4 to strengthen the firm's roof with more nails. About 70 per cent of the enterprises have applied this measure in the past. However, firms only rate this measure as the second most effective.

The measure firms rate as most effective is to clean the firm's neighbourhoods' drainage canals in a joint effort with their neighbours. It is also one of the measures most applied by the firms: about two-thirds of the enterprises have applied it in the past. However, the willingness to apply this measure is only ranked fifth out of the ten measures. The measure that firms have applied least in the past is also rated least effective and firms are least willing to apply it: only about 20 per cent of the firms have changed their location. Firms' willingness to apply this is ranked slightly lower than 3 (out of 5), and its ranked effectiveness is close to 4 (out of 7).

Figure 3: Information treatment messages

PROTECT YOUR ENTERPRISE OF THE IMPACT OF CYCLONES AND FLOODS

The following images show protection measures that your enterprise can use. The measures show how to prepare and protect your enterprise for cyclones and floods. Please read the explanations in the following pictures.

Source: pictures created by INGD and UN-HABITAT. Information message at the top created by the authors.

Table 2: Summary statistics of disaster preparedness at baseline

	Willingness[1]		Effectiveness[2]		Practice[3]	
	Treated	Control	Treated	Control	Treated	Control
Disaster preparedness measures from pictures						
DP1: Strengthen windows with sheet covers or plywood	3.938	3.877	4.983	4.923	0.458	0.491
held by wooden or metallic battens	(0.068)	(0.059)	(0.087)	(0.079)	(0.032)	(0.028)
DP2: Strengthen doors with wooden or metallic	3.976	3.917	5.056	4.950	0.490	0.515
crossbars fixed to the wall	(0.063)	(0.058)	(0.080)	(0.074)	(0.032)	(0.027)
DP3: Strengthen roof between beams with metallic	3.949	3.962	4.967	4.946	0.551	0.534
strings or straps	(0.060)	(0.052)	(0.082)	(0.069)	(0.030)	(0.026)
DP4: Strengthen roof with more nails	4.165	4.127	5.271	5.194	0.523	0.572
	(0.055)	(0.046)	(0.074)	(0.064)	(0.029)	(0.024)
DP5: Elevate material	3.680	3.670	5.013	4.952	0.523	0.572
	(0.054)	(0.048)	(0.082)	(0.072)	(0.029)	(0.024)
DP6: In collaboration with neighbours -	3.820	3.797	5.290	5.392	0.560	0.591
clean neighbourhood drainage canals	(0.045)	(0.043)	(0.072)	(0.058)	(0.029)	(0.024)
Index of six measures in pictures	19.420	18.914	27.820	27.187	2.950	3.029
	(0.340)	(0.306)	(0.433)	(0.385)	(0.118)	(0.099)
Disaster preparedness measures not shown in pictures						
DP7: Protection wall	3.537	3.409	5.010	4.799*	0.347	0.325
	(0.061)	(0.055)	(0.085)	(0.079)	(0.028)	(0.023)
DP8: Use sandbags	3.490	3.371	4.740	4.598	0.490	0.486
	(0.055)	(0.052)	(0.080)	(0.075)	(0.029)	(0.024)
DP9: Plant trees	3.337	3.251	4.693	4.526	0.407	0.371
	(0.063)	(0.056)	(0.094)	(0.084)	(0.028)	(0.024)
DP10: Change location	2.947	2.849	3.913	3.833	0.183	0.218
	(0.064)	(0.055)	(0.101)	(0.084)	(0.022)	(0.020)
Index of four measures *not* in pictures	13.310	12.880*	18.357*	17.756*	1.987	1.990
	(0.165)	(0.153)	(0.256)	(0.234)	(0.084)	(0.072)
Index combining all ten measures	34.657	33.718*	46.177	44.943	4.377	4.428
	(0.408)	(0.377)	(0.565)	(0.510)	(0.164)	(0.139)
Number of firms	300	418	300	418	300	418

Note: [1] on a scale from 1 (fully unwilling) to 5 (highly willing), how willing are you to implement the following measure? [2] On a scale from 1 (fully inefficient) to 7 (highly efficient), how do you evaluate the efficiency of the following measure? [3] Binary variable if the firm has ever applied this measure in the past. Mean estimates. ***Significance of t-tests between treatment and control group at $p<0.01$, ** $p<0.05$, * $p<0.1$ level. The specific survey questions are further outlined in Appendix Tables A6 and A7.
Source: authors' calculations based on IIM 2022 information treatment data.

Sample attrition is higher than usual in Mozambique. We managed to follow-up with 82 per cent of the baseline enterprises. In other studies we had annual attrition of less than 10 per cent (Berkel et al. 2022, 2021). Attrition is higher because many interviewees rejected providing confidential information over the phone. This implies that not all exit firms stopped their operations. To examine attrition bias, we carefully compare surviving and exit firms in Appendix Table A3.

We find very few differences between exiting and surviving firms. Among the survivors, significantly more firms are located in Maputo (38 per cent) than among exiting firms (29 per cent). The opposite is the case for Manica: there are significantly more firms among the exits located in Manica (32 per cent) than among survivors (23 per cent). Hence, there might be a slight bias towards Maputo. Nevertheless, there are no major differences between exits and survivors regarding sectors. Only among brickmakers were there significantly more exits (12 per cent) than survivors (7 per cent). Exits tend to be more informal than survivors; only 10 per cent of exits were registered at the one-stop shop,[2] and 11 per cent made social security contributions relative to 18 per cent and 16 per cent among survivors. Thus, the sample might have a slight bias towards formal enterprises. There are no significant differences in terms of risk perceptions, and the same goes for the main disaster preparedness outcome variables between exiting firms and survivors. Thus, there is no need to be concerned about attrition bias. If anything, there is a small bias towards more formal firms and firms located in Maputo. These firms are likely to be more productive than firms that left the sample.

4 Methodology

We examine the socio-psychological determinants of the disaster preparedness of enterprises. As statistical inference is most likely erroneous due to unobserved heterogeneity, we exploit our data's panel nature and control for firm and time fixed effects. Let DP be our outcome of interest (i.e. disaster preparedness) measured either as an index or as an individual measure of firm i at time t, while EO, EXP, $CCKnow$, and $Values$ represent potential socio-demographic, cognitive, experiential, and socio-cultural determinants of disaster preparedness:

$$DP_{i,t} = \alpha_i + \beta_1 EO_{i,t} + \beta_2 EXP_{i,t} + \beta_3 CCKnow_{i,t} + \beta_4 Values_{i,t} + \gamma_t + \varepsilon_{i,t} \quad (1)$$

In a second step, we examine whether providing firms with information about specific disaster preparedness measures that they can apply impacts their attitudes towards, and de facto, disaster preparedness. Thus, we investigate whether the provision of information had a statistically significant effect on the firms that received the information (i.e. the average treatment effect on the treated (ATT)). We use a standard difference-in-differences approach:

$$DP_{i,t} = \alpha + \beta_1 INFO_i + \beta_2 TIME_t + \beta_3 INFO \times TIME_{i,t} + \varepsilon_{i,t} \quad (2)$$

DP continues to be our outcome of interest—that is, disaster preparedness measured either as an index or as an individual measure of firm i at time t. $INFO$ is a dummy indicating whether the firm has received information about disaster preparedness measures. $TIME$ is a dummy equal to 1 if the observation is from the post-treatment point.

5 Results

5.1 Socio-psychological characteristics and disaster preparedness

We first examine the socio-psychological characteristics associated with firms' disaster preparedness. Disaster preparedness is represented by five outcome variables: two specific disaster preparedness measures (DP4 and DP10) and three indices of disaster preparedness. The two specific disaster preparedness measures are the two most commonly used and least used measures by enterprises. The most commonly used measure is to strengthen the firm's roof with more nails (DP4). More than half of the sample (55

[2] The authority that combines all types of business licensing and registration into a single registration.

per cent) have used this measure at least once in the past. The least used measure is to change the firm's location (DP10) to prepare for possible disasters. Only 20 per cent of the firms have moved their establishment to prepare for extreme weather. A 'picture index' includes all six preparedness measures (DP1–6) that we showed to firms in the four pictures in Figure 3, and a 'no picture index' includes four additional preparedness measures that we did not show to the firms but asked about (DP7–10). The 'All' index includes all ten disaster preparedness measures combined (DP1–10). We distinguish between attitudes towards and de facto disaster preparedness. Attitudes towards disaster preparedness are measured as both firms' willingness to apply disaster preparedness measures and firms' evaluated effectiveness of disaster preparedness measures. De facto disaster preparedness is measured as the active use of disaster preparedness measures.

Table 3 shows associations between socio-psychological characteristics and disaster preparedness. Table 3 illustrates that there is no multicollinearity problem in our analysis. The socio-psychological characteristics associated with disaster preparedness are knowledge about climate change, personal values, and social norms. Knowledge about climate change is strongly correlated with both attitudes towards and de facto disaster preparedness. This means that firm owners with more knowledge about climate change are more likely to be disaster-prepared. Descriptive values (i.e. the degree to which other firm owners are acting to reduce the risk of extreme weather) are strongly associated with attitudes towards and de facto disaster preparedness. Previous research has shown that an individual's behaviour, including their disaster preparedness, is influenced by reference groups' behaviour (Ng 2022), and this might be even more so in collectivist cultures such as Mozambique (Saracevic and Schlegelmilch 2021; Soyez 2012). A personal value that is strongly correlated with both attitudes towards and de facto disaster preparedness is egoism (i.e. maximizing individual outcomes). Egoistic values are particularly associated with the evaluated effectiveness and de facto use of disaster preparedness measures.

Table 3: Socio-psychological characteristics and disaster preparedness

	Willingness					Effectiveness					Practice				
	DP4	DP10	Pictures	No pictures	All	DP4	DP10	Pictures	No pictures	All	DP4	DP10	Pictures	No pictures	All
Firm characteristics															
Entrepreneurial	–0.044	–0.025	0.010	0.044	0.032	0.045	–0.080	0.044	0.021	0.045	0.081*	0.020	0.052	0.056	0.051
Orientation	(0.042)	(0.036)	(0.038)	(0.035)	(0.037)	(0.044)	(0.037)	(0.037)	(0.038)	(0.037)	(0.043)	(0.039)	(0.040)	(0.038)	(0.036)
Disaster	0.045	0.002	–0.002	–0.016	–0.001	0.034	–0.040	–0.027	–0.069	–0.052	0.098*	0.133**	0.123**	0.185***	0.155***
experience	(0.055)	(0.052)	(0.051)	(0.047)	(0.049)	(0.057)	(0.049)	(0.048)	(0.047)	(0.049)	(0.056)	(0.052)	(0.045)	(0.046)	(0.048)
Climate change	0.045	0.002	0.106**	0.016	0.086**	0.096**	0.039	0.119**	0.064	0.123***	0.092**	0.150***	0.123**	0.113**	0.147***
knowledge	(0.082)	(0.065)	(0.038)	(0.035)	(0.038)	(0.044)	(0.037)	(0.037)	(0.038)	(0.038)	(0.044)	(0.040)	(0.040)	(0.038)	(0.037)
Social norms															
Descriptive	0.077*	0.194***	0.065	0.183***	0.126***	0.006	0.182***	0.016	0.101**	0.057	0.048	0.184***	0.101**	0.208***	0.163***
	(0.041)	(0.033)	(0.040)	(0.036)	(0.038)	(0.045)	(0.038)	(0.040)	(0.036)	(0.038)	(0.044)	(0.040)	(0.036)	(0.036)	(0.037)
Prescriptive	0.021	–0.070*	–0.052	–0.011	–0.052	0.007	–0.112***	–0.067	–0.064	–0.081**	0.088*	–0.143***	0.047	–0.030	0.017
	(0.040)	(0.036)	(0.041)	(0.037)	(0.038)	(0.045)	(0.039)	(0.041)	(0.037)	(0.038)	(0.045)	(0.040)	(0.037)	(0.038)	(0.037)
Personal values															
Affect	0.010	–0.006	0.052	–0.023	0.029	0.065	0.029	0.080*	0.046	0.084**	–0.042	–0.065*	–0.033	–0.035	–0.040
	(0.042)	(0.033)	(0.036)	(0.034)	(0.035)	(0.042)	(0.035)	(0.036)	(0.035)	(0.035)	(0.042)	(0.037)	(0.035)	(0.038)	(0.034)
Biospheric	–0.006	0.017	0.038	–0.018	0.038	–0.041	–0.006	0.021	–0.015	0.010	0.011	–0.064	0.011	–0.026	–0.010
	(0.051)	(0.041)	(0.044)	(0.039)	(0.042)	(0.049)	(0.042)	(0.044)	(0.038)	(0.042)	(0.048)	(0.044)	(0.038)	(0.042)	(0.041)
Altruistic	–0.090*	–0.114***	–0.043	–0.070	–0.051	–0.123**	–0.159***	–0.046	–0.155***	–0.105**	–0.049	–0.026	–0.018	–0.054	–0.022
	(0.044)	(0.041)	(0.043)	(0.036)	(0.042)	(0.048)	(0.042)	(0.044)	(0.038)	(0.042)	(0.048)	(0.045)	(0.040)	(0.041)	(0.041)
Egoistic	0.051	0.079**	0.012	0.016	0.008	0.081*	0.164***	0.050	0.119***	0.092**	0.129***	0.026	0.122***	0.058	0.121***
	(0.043)	(0.036)	(0.040)	(0.035)	(0.037)	(0.045)	(0.036)	(0.041)	(0.035)	(0.037)	(0.045)	(0.039)	(0.034)	(0.034)	(0.036)
Number of firms	1,273	1,436	1,436	1,436	1,436	1,273	1,436	1,436	1,436	1,436	1,273	1,436	1,436	1,436	1,436
R^2	0.01	0.03	0.005	0.056	0.043	0.020	0.025	0.008	0.012	0.016	0.069	0.047	0.113	0.073	0.128

Note: mean estimates

Source: authors' calculations based on MSMC data.

An outstanding difference between the attitudes towards disaster preparedness and de facto disaster preparedness is experience with disasters. When a firm has experienced at least one disaster in the past, it is more likely to apply disaster preparedness measures. Yet, disaster experience does not seem to make a significant difference in the attitudes towards disaster preparedness relative to de facto disaster preparedness. It makes sense that firms that have experienced disasters learn from these experiences and, therefore, prepare for future disasters. Attitudes towards disaster preparedness are less dependent on disaster experience because it is much easier to have positive attitudes towards disaster preparedness and acknowledge that it is crucial than to actually implement disaster preparedness measures.

In contrast to other studies (Brosch 2021; van der Linden 2015), affect is not one of the main predictors of disaster preparedness among Mozambican entrepreneurs. On the contrary, in our study almost all of the associations between affect and disaster preparedness are statistically insignificant. This is important because the academic literature places a strong focus on affect and emotions related to climate change and disasters. Affect might be an essential factor in Western contexts. However, among highly vulnerable populations in a low-income setting, affect might be less relevant.

In contrast to van der Linden (2015), who studies the UK, biospheric values (i.e. caring about nature and the biosphere) do not play a significant role in disaster preparedness in Mozambique. An explanation for the statistically insignificant association between biospheric values and disaster preparedness in Mozambique might be the high biospheric value and small variation among entrepreneurs. The mean biospheric value is 36 out of 40 (on a scale from 18 to 40), probably because people feel more connected to nature as, even in cities, people grow their own food, and precolonial animism is strongly connected to nature (i.e. people believed that plants possess a spirit) (Martin and Czellar 2017). In Western countries there are starker differences in biospheric values between individuals.

5.2 Does information enhance disaster preparedness?

We provided firms with information about specific disaster preparedness measures they can apply. Figure 3 illustrates the detailed images showing six disaster preparedness measures that we provided to firms. This allows us to examine whether information provision impacts firm owners' attitudes towards, and their de facto, disaster preparedness. Specifically, we estimate the ATT of information provision on the attitudes towards, and de facto application of, each of the ten preparedness measures we asked about.

Table 4 illustrates that the information about specific disaster preparedness measures did not impact firms' disaster preparedness. Information provision, if anything, had a negative impact on the attitudes towards disaster preparedness. Several associations between information provision and attitudes towards disaster preparedness are negative, albeit statistically insignificant. The relationship between information and de facto disaster preparedness is positive but statistically insignificant as well. Thus, overall, the type of information we gave to firms did not have any effect on firms' disaster preparedness.

The insignificant effect of the images is not necessarily surprising, as previous studies conducted in high-income countries have come to similar results. In particular, Osberghaus and Hinrichs (2021) evaluate a large-scale flood-risk awareness campaign in Germany and do not obtain any significant effects on the use of flood protection measures by households. They explain that it is highly challenging to translate information into action. Moreover, we only provided information and did not try to mobilize people to act. In another project in the city of Quelimane in Mozambique, community leaders mobilized their neighbourhoods to prepare for disasters after showing videos and sending SMS messages about flood preparedness. The combined intervention of information and community mobilization through local leaders proved successful: households did not only prepare themselves for disasters, but were also impacted less when floods struck again (Leeffers 2023; Newman et al. 2019). It is probably the actions of community leaders rather than the information itself that led to the positive effect.

Table 4: Information and disaster preparedness: DiD

	Willingness	Effectiveness	Practice
Disaster preparedness measures from pictures			
DP1: Strengthen windows with sheet covers or plywood held by wooden our metallic battens	0.043	0.045	0.068
	(0.122)	(0.121)	(0.122)
Observations	1,089	1,089	1,089
R^2	0.003	0.003	0.023
DP2: Strengthen doors with wooden or metallic crossbars fixed to the wall	–0.093	–0.121	0.042
	(0.119)	(0.120)	(0.118)
Number of firms	1,138	1,138	1,138
R^2	0.001	0.001	0.039
DP3: Strengthen roof between beams with metallic strings or straps	–0.006	0.030	0.084
	(0.114)	(0.114)	(0.112)
Number of firms	1,260	1,260	1,260
R^2	0.001		
DP4: Strengthen roof with more nails	0.012	–0.028	0.092
	(0.113)	(0.114)	(0.113)
Number of firms	1,273	1,273	1,273
R^2	0.008	0.009	0.007
DP5: Elevate material	0.051	–0.005	0.080
	(0.106)	(0.106)	(0.107)
Number of firms	1,436	1,436	1,436
R^2	0.001	0.002	0.010
DP6: In collaboration with neighbours clean neighbourhood drainage canals	–0.133	–0.075	0.042
	(0.106)	(0.105)	(0.107)
Number of firms	1,436	1,436	1,436
R^2	0.012	0.042	0.001
Pictures	–0.113	–0.133	0.039
Index	(0.106)	(0.106)	(0.106)
Number of firms	1,436	1,436	1,436
R^2	0.007	0.015	0.014
Disaster preparedness measures not shown in pictures			
DP7: Protection wall	–0.176*	–0.192*	–0.022
	(0.106)	(0.106)	(0.107)
Number of firms	1,436	1,436	1,436
R^2	0.003	0.007	0.001
DP6: Use sandbags	–0.134	–0.136	0.001
	(0.106)	(0.106)	(0.107)
Number of firms	1,436	1,436	1,436
R^2	0.002	0.003	0.005
DP9: Plant trees	–0.096	–0.034	0.005
	(0.106)	(0.106)	(0.107)
Number of firms	1,436	1,436	1,436
R^2	0.004	0.006	0.005
DP10: Change location	–0.020	–0.038	0.169
	(0.107)	(0.107)	(0.107)
Number of firms	1,436	1,436	1,436
R^2	0.001	0.000	0.005
No pictures	–0.156	–0.142	0.057
Index	(0.106)	(0.106)	(0.107)
Number of firms	1,436	1,436	1,436
R^2	0.003	0.006	0.001
Disaster preparedness	–0.172	–0.169	0.051
Index	(0.106)	(0.106)	(0.106)
Number of firms	1,436	1,436	1,436
R^2	0.009	0.017	0.010

Note: mean estimates.
Source: authors' calculations based on MSMC data.

There are several other possible explanations for this insignificant effect of the images on firms' disaster preparedness. First, the images were shown during the dry season when neither cyclones nor floods

occur. Thus, firms did not have a chance to implement the measures we illustrated. Second, despite being relatively easy and inexpensive to implement, the firms might nevertheless have insufficient means to implement the measures. They are facing a complex combination of challenges such that most of them are struggling for survival on a daily basis instead of growing their businesses. Hence, any additional expenses that firms need to bear are too much. Third, we delivered the information on a hard copy leaflet. Other and more diversified communication channels such as TV, radio, or SMS, as well as the repeated communication of the same information and framing the information positively might be more effective (Leeffers 2023; Maidl and Buchecker 2015; Osberghaus and Hinrichs 2021; Zaman 2021). Third, we might have needed to combine the images with additional information that has proven useful elsewhere, such as information about the high risk of disasters (De Boer et al. 2014; Maidl and Buchecker 2015) or success stories of similar entrepreneurs preparing for disasters (Appleby-Arnold et al. 2018; De Meyer et al. 2020) (a similar information campaign was discussed by Olmedo et al. (2020)).

5.3 Heterogeneity

We continue to explore the association between socio-psychological characteristics and information provision, on the one hand, and disaster preparedness, on the other. For this purpose, we start by disaggregating some of the explanatory variables. Specifically, disaster experience is disaggregated into cyclone experience and flood experience. Climate change knowledge is divided into knowledge about (1) the causes of climate change; (2) the consequences of climate change; and (3) the physics of climate change.

Table 5 shows that both previous experience with cyclones and previous experience with floods are associated with de facto disaster preparedness. This association is less pronounced for the perceived effectiveness of disaster preparedness measures. Regarding knowledge about climate change, we find that it is knowledge about the causes of climate change that is particularly associated with disaster preparedness.

Table 5: Climate change knowledge, disaster experience, and disaster preparedness: FE

	Effectiveness					Practice				
	DP4	DP10	Pictures	No Pictures	All	DP4	DP10	Pictures	No Pictures	All
Disaster experience										
Cyclone experience	–0.052	–0.069*	0.006	–0.086*	–0.034	0.034	0.015	0.050	0.097*	0.087**
	(0.043)	(0.057)	(0.039)	(0.038)	(0.039)	(0.044)	(0.042)	(0.037)	(0.039)	(0.038)
Floods experience	0.057*	0.018	–0.020	0.008	–0.012	0.042	0.082**	0.051	0.062*	0.048*
	(0.032)	(0.029)	(0.029)	(0.027)	(0.027)	(0.032)	(0.033)	(0.028)	(0.029)	(0.027)
Climate change knowledge										
Causes of climate change	0.064	0.100**	0.124**	0.081	0.135***	0.039	0.089*	0.081*	0.068	0.087**
	(0.050)	(0.042)	(0.043)	(0.042)	(0.042)	(0.050)	(0.046)	(0.041)	(0.042)	(0.039)
Consequences of climate change	0.000	–0.105***	–0.002	–0.098*	–0.045	0.024	0.090**	0.059	0.087*	0.080**
	(0.046)	(0.041)	(0.039)	(0.038)	(0.039)	(0.044)	(0.040)	(0.038)	(0.040)	(0.036)
Physics of climate change	0.064	0.051	0.026	0.092*	0.062	0.053	0.020	0.031	0.003	0.020
	(0.047)	(0.040)	(0.040)	(0.038)	(0.038)	(0.050)	(0.042)	(0.040)	(0.040)	(0.037)
Number of firms	1,273	1,436	1,436	1,436	1,436	1,273	1,436	1,436	1,436	1,436
R^2	0.012	0.016	0.014	0.006	0.022	0.068	0.044	0.113	0.071	0.130

Note: mean estimates. The control variables *entrepreneurial orientation*, *affect*, *descriptive values*, *prescriptive values*, *biospheric values*, *altruistic values*, and *egoistic values* are included but coefficients are not reported here.
Source: authors' calculations based on MSMC data.

It is possible that our information provision did not have any general effects, but that it nevertheless had effects on specific sub-groups. Thus, we divide the sample into own-account (0–1 employees) and bigger enterprises (5–9 employees). Now the results are less pronounced (see Table 6). We find that the associations between climate change knowledge, descriptive norms, and egoistic values, on the one hand, and disaster preparedness, on the other, are much weaker than for the full sample. If anything, these associations remain significant for the bigger enterprises but not for the own-account firms. Thus, our results seem to be driven by firms that have several employees.

Surprisingly, information provision seems to have negatively impacted the evaluated effectiveness of several disaster preparedness measures among own-account firms (see Table 7). In contrast, the effect of information provision on evaluated effectiveness is significantly positive among bigger enterprises. Specifically, the effect of information on the evaluated effectiveness of 'DP2: Strengthening doors with wooden or metallic crossbars fixed to the walls' and 'DP3: Strengthening the roof between beams with metallic strings or straps' is negative for own-account firms and positive for bigger micro-enterprises. Further, the effect of information on all ten adaptation measures is statistically negative for own-account enterprises. Yet, it is statistically insignificant but positive for bigger enterprises.

We continue examining the information provision experiment by dividing the sample into two groups based on the firm owners' various socio-psychological characteristics. Specifically, we split the sample into firms with (1) no disaster experience and firms with disaster experience (see Appendix Table A8); (2) low knowledge about climate change and high knowledge about climate change (see Appendix Table A9); (3) low descriptive norms and high descriptive norms (see Appendix Table A9); and (4) low egoistic values and high egoistic values (see Appendix Table A11). We find that the information about disaster preparedness measures did not have any significant effect on the different groups. We only find that the relationship between information and disaster preparedness is weaker for firms that already experienced at least one disaster in the past relative to the relationship between information and disaster preparedness for firms that have never experienced any disaster.

Table 6: Socio-psychological characteristics and disaster preparedness

	Willingness				Effectiveness				Practice			
	Pictures index		Index all		Pictures index		Index all		Pictures index		Index all	
	OA	Bigger	OA	Bigger	OA	Bigger	OA	Bigger	OA	Bigger	OA	Bigger
Firm characteristics												
Entrepreneurial	0.134	–0.010	0.054	–0.054	0.147	0.037	0.041	0.027	0.099	0.176*	0.080	0.194*
Orientation	(0.091)	(0.070)	(0.067)	(0.081)	(0.091)	(0.072)	(0.059)	(0.079)	(0.077)	(0.075)	(0.069)	(0.084)
Disaster	–0.062	–0.029	–0.011	–0.182	–0.076	–0.084	0.009	–0.334***	0.0798	0.043	0.096	0.161
experience	(0.110)	(0.082)	(0.082)	(0.094)	(0.113)	(0.080)	(0.093)	(0.095)	(0.079)	(0.087)	(0.092)	(0.089)
Climate change	0.054	0.091	–0.128	0.054	0.043	0.120	–0.002	0.151	0.078	0.213**	0.060	0.122
knowledge	(0.083)	(0.069)	(0.070)	(0.076)	(0.079)	(0.068)	(0.072)	(0.077)	(0.087)	(0.068)	(0.076)	(0.080)
Social norms												
Descriptive	0.078	0.075	0.129*	0.219**	0.026	0.016	0.076	0.188**	0.091	0.155*	0.128	0.246***
	(0.087)	(0.080)	(0.065)	(0.074)	(0.090)	(0.076)	(0.072)	(0.062)	(0.071)	(0.064)	(0.066)	(0.072)
Prescriptive	–0.123	–0.022	0.042	–0.066	–0.124	–0.022	–0.011	–0.147*				
	(0.087)	(0.075)	(0.073)	(0.073)	(0.087)	(0.072)	(0.082)	(0.071)	(0.071)	(0.064)	(0.066)	(0.072)
Personal values												
Affect	0.121	0.024	–0.060	–0.049	0.145*	0.067	–0.057	0.037	0.009	–0.037	–0.048	–0.010
	(0.072)	(0.054)	(0.062)	(0.061)	(0.072)	(0.055)	(0.060)	(0.058)	(0.068)	(0.053)	(0.058)	(0.074)
Biospheric	0.228*	–0.004	–0.065	0.059	0.177	–0.009	–0.136	0.022	0.126	–0.032	0.049	–0.079
	(0.091)	(0.067)	(0.078)	(0.075)	(0.092)	(0.065)	(0.081)	(0.074)	(0.075)	(0.076)	(0.072)	(0.082)
Altruistic	–0.203	–0.056	0.031	–0.056	–0.147	–0.047	–0.018	–0.116	–0.014	–0.063	–0.109	–0.067
	(0.110)	(0.075)	(0.087)	(0.082)	(0.113)	(0.073)	(0.099)	(0.081)	(0.083)	(0.081)	(0.078)	(0.090)
Egoistic	–0.055	–0.029	–0.006	–0.021	–0.008	0.022	0.121	0.062	0.120*	0.081	0.142*	–0.059
	(0.091)	(0.072)	(0.065)	(0.067)	(0.100)	(0.069)	(0.068)	(0.065)	(0.061)	(0.065)	(0.059)	(0.065)
Number of firms	368	388	368	388	368	388	368	388	368	388	368	388
R^2	0.001	0.010	0.000	0.012	0.004	0.000	0.005	0.001	0.131	0.100	0.023	0.123

Note: mean estimates.

Source: authors' calculations based on MSMC data.

Table 7: Information and disaster preparedness

	Own-account			>4 employees		
	Willingness	Effectiveness	Practice	Willingness	Effectiveness	Practice
DP1: Strengthen windows with sheet covers or plywood	–0.053	–0.378	–0.154	0.144	0.550**	0.264
	(0.242)	(0.241)	(0.245)	(0.232)	(0.229)	(0.237)
Observations	265	265	265	311	311	311
DP2: Strengthen doors with wooden or metallic	–0.198	–0.492**	–0.006	0.317	0.442*	0.298
crossbars fixed to the wall	(0.242)	(0.234)	(0.242)	(0.224)	(0.244)	(0.226)
Number of firms	275	275	275	319	319	319
DP3: Strengthen roof between beams	–0.155	–0.394*	0.015	0.362*	0.335	0.213
with metallic strings or straps	(0.235)	(0.230)	(0.22)	(0.216)	(0.207)	(0.221)
Number of firms	307	307	307	351	351	351
DP4: Strengthen roof with more nails	–0.133	–0.120	0.034	0.155	0.114	0.104
	(0.215)	(0.219)	(0.229)	(0.241)	(0.243)	(0.227)
Number of firms	310	310	310	356	356	356
DP5: Elevate material	0.036	–0.254	–0.030	0.092	0.326	0.218
	(0.191)	(0.205)	(0.207)	(0.213)	(0.209)	(0.213)
Number of firms	368	368	368	388	388	388
DP6: In collaboration with neighbours	0.207	–0.010	–0.028	0.002	0.130	0.344
clean neighbourhood drainage canals	(0.205)	(0.208)	(0.210)	(0.213)	(0.216)	(0.214)
Number of firms	368	368	368	388	388	388
Index of six measures in pictures	–0.324	–0.417	–0.127	0.117	0.158	0.280
	(0.230)	(0.228)	(0.212)	(0.193)	(0.198)	(0.210)
Number of firms	368	368	368	388	388	388
DP7: Protection wall	–0.286	–0.508**	–0.093	–0.201	0.047	0.082
	(0.206)	(0.216)	(0.206)	(0.221)	(0.211)	(0.220)
Number of firms	368	368	368	388	388	388
DP8: Use sandbags	–0.243	–0.327	–0.036	–0.296	–0.213	–0.016
	(0.197)	(0.204)	(0.209)	(0.208)	(0.215)	(0.216)
Number of firms	368	368	368	388	388	388
DP9: Plant trees	–0.055	–0.270	0.007	–0.348	–0.145	–0.095
	(0.207)	(0.207)	(0.209)	(0.222)	(0.210)	(0.215)
Number of firms	368	368	368	388	388	388
DP10: Change location	0.029	–0.114	0.224	0.067	0.116	–0.098
	(0.209)	(0.206)	(0.200)	(0.214)	(0.218)	(0.210)
Number of firms	368	368	368	388	388	388
Index of four measures not in pictures	–0.200	–0.439*	0.010	–0.285	–0.064	0.084
	(0.207)	(0.212)	(0.198)	(0.206)	(0.193)	(0.226)
Number of firms	368	368	368	388	388	388
Index combining all ten measures	–0.275	–0.527**	–0.083	–0.091	0.097	0.187
	(0.222)	(0.223)	(0.204)	(0.199)	(0.194)	(0.215)
Number of firms	368	368	368	388	388	388

Note: mean estimates.

Source: authors' calculations based on MSMC data.

5.4 Risk perception as a mechanism

Individuals act when they perceive a need to act. Individuals' risk perception has been shown to change people's behaviour (Ferrer and Klein 2015). For example, climate change risk perceptions are associated with environmentally relevant behaviour (Bradley et al. 2020). Along these lines, individuals' risk perceptions are likely to influence their disaster preparedness. Thus, we examine whether firm owners' climate change risk perceptions mediate the relationships between their socio-psychological characteristics and their firms' disaster preparedness.

Table 8 confirms our hypothesis. The association between firm owners' socio-psychological characteristics and their firms' disaster preparedness appears to be driven by firm owners' risk perception. Specifically, the magnitude of the previously identified statistically significant associations between climate change knowledge, descriptive norms, and egoistic values, on the one hand, and disaster preparedness, on the other, is slightly reduced when adding risk perceptions to the analysis.

Table 8: Risk perception as a mechanism

	Willingness		Effectiveness		Practice	
		Mechanism		Mechanism		Mechanism
Risk perception		0.096**		0.079*		0.030
		(0.047)		(0.048)		(0.046)
Firm characteristics						
Entrepreneurial	0.032	0.027	0.045	0.040	0.051	0.049
Orientation	(0.039)	(0.039)	(0.039)	(0.039)	(0.037)	(0.036)
Disaster experience	–0.001	–0.018	–0.052	–0.066	0.155***	0.150***
	(0.046)	(0.047)	(0.045)	(0.046)	(0.044)	(0.045)
Climate change knowledge	0.086**	0.078**	0.123***	0.117***	0.147***	0.144***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.038)	(0.039)
Social norms						
Descriptive	0.126***	0.111***	0.057	0.045	0.163***	0.158***
	(0.040)	(0.040)	(0.038)	(0.038)	(0.035)	(0.035)
Prescriptive	–0.052	–0.055	–0.081**	–0.084**	0.017	0.016
	(0.042)	(0.041)	(0.040)	(0.040)	(0.037)	(0.037)
Personal values						
Affect	0.029	–0.021	0.084**	0.043	–0.040	–0.056
	(0.035)	(0.042)	(0.035)	(0.042)	(0.036)	(0.044)
Biospheric	0.038	0.040	0.010	0.011	–0.010	–0.009
	(0.042)	(0.042)	(0.041)	(0.041)	(0.038)	(0.038)
Altruistic	–0.051	–0.049	–0.105**	–0.103**	–0.022	0.021
	(0.041)	(0.041)	(0.042)	(0.042)	(0.040)	(0.040)
Egoistic	0.008	0.002	0.092**	0.087**	0.121***	0.119***
	(0.038)	(0.037)	(0.040)	(0.040)	(0.033)	(0.033)
Number of firms	1,436	1,436	1,436	1,436	1,436	1,436
R^2	0.043	0.045	0.016	0.017	0.128	0.129

Note: mean estimates including firm and time fixed effects.

Source: authors' calculations based on MSMC data.

6 Robustness

The main sample of this study is not representative of Mozambican micro-enterprises. However, we have a sub-sample of 581 enterprises representative at the city level. This representative sub-sample includes the cities of Maputo, Beira, and Chimoio. Specifically, to create a representative sample of micro-enterprises, we used a stratified adaptive cluster sampling approach (Jolevski and Ayana Aga 2019; Thompson 1990, 1991). We started by dividing the areas for examination (i.e. Maputo, Beira, and Chimoio) into squares of 115×115 m. In a second step, we randomly selected 200 squares in each city. To account for uneven population density, we weighted the random draw of cells by information on the thickness of structures in each cell, following Malmgren-Hansen et al. (2020). The project's enumerators located all micro-businesses that operated in the selected squares. When they found one or more firms in a square, they also inspected the neighbouring squares (i.e. the squares north, south, east, and west of the original square) for enterprises. We believe that our sample is representative of the manufacturing sector in the respective cities since almost all firms that we found when walking through the whole town participated in our inquiry.

We re-run the previous analysis, restricting our sample to Maputo, Beira, and Chimoio, where the sample is representative of micro-enterprises (see Table A12). As found previously, climate change knowledge, descriptive norms, and egoistic values are significantly associated with disaster preparedness. The association between descriptive norms and disaster preparedness appears to be particularly strong. A slight difference is that climate change knowledge is more relevant for the perceived effectiveness of, and de facto, disaster preparedness but less so for the willingness to prepare for disasters. Similarly, egoistic values are primarily associated with the perceived effectiveness of and de facto disaster preparedness rather than with the willingness to prepare for disasters. As in our main sample, previous disaster ex-

perience correlates with de facto disaster preparedness. Thus, using the representative sample instead of the bigger main sample leads us to the same patterns about the association between firm owners' socio-psychological characteristics and disaster preparedness. We also confirm that the provision of information about disaster preparedness measures did not have an effect on firms' disaster preparedness (see Table A13).

The information about disaster preparedness we provided to enterprises had already been circulated in Mozambique by the National Institute for Disaster Management and Risk Reduction (INGD) and UN-HABITAT. Thus, it is possible that our treatment did not have any effect because the firms had already obtained the same information previously. As we asked the firms if they had ever seen the same pictures before, we can divide the sample into firm owners who already knew of the pictures and firm owners who saw the pictures for the first time when we showed them. Appendix Table A5 illustrates that the firm owners who had already seen the pictures are not fundamentally different in characteristics from those who had never seen them. Table A14 confirms that our information provision did not have a statistically significant effect on firms' disaster preparedness. Nevertheless, it illustrates that, despite being statistically insignificant, the magnitude of the association between provided information and disaster preparedness is stronger for the firms that had never seen the information before than for firms that had seen the information previously.

Throughout this study we have jointly examined firm owners and managers. In 15 of 718 firms we interviewed employees because neither the owner nor the manager were available. Individuals who own a firm might be more concerned about its disaster preparedness than managers or employees. Owners depend more on the firm's success and have invested more resources than managers and workers, who might find it easier to work for a different firm if the current one has to close after a disaster. Further, the decision to prepare a firm for disaster might depend more on the owner than the manager. Thus, Table A15 looks separately at the socio-psychological characteristics of owners and managers and how these are associated with disaster preparedness. As assumed, climate change knowledge of firm owners is significantly associated with firms' disaster preparedness, but not that of managers. Similarly, the magnitude of the association between descriptive norms and egoistic values, on the one hand, and disaster preparedness, on the other, is stronger for firm owners. Regarding information provision, we do not detect major differences between firm owners and managers, confirming that our information provision experiment did not have any effects on disaster preparedness (see Table A16).

7 Conclusion

Micro-enterprises are vital job providers and are frequently hit by disasters in low- and middle-income countries. As disasters will increase in frequency and intensity due to anthropogenic climate change, it is necessary to understand what makes enterprises prepare for disasters to ensure their survival. Thus, in the first step, we examined in this paper the association between socio-psychological characteristics of firm owners and their firms' disaster preparedness through standard econometric analyses. The second step involves an information provision experiment. We showed firms pictures that illustrate and explain six disaster preparedness measures that are easy to apply.

Our study aims to contribute to the scant literature on understanding the determinants of disaster preparedness. Specifically, understanding why business owners perceive risks in different ways and how this affects disaster preparedness remains a research gap (Harries et al. 2018). Instead of taking one measure of risk perception, we therefore used four socio-psychological characteristics that are associated with individuals' climate change risk perceptions (van der Linden 2015; Xie et al. 2019). We then examined how these socio-psychological characteristics relate to disaster preparedness. Our findings highlight three main socio-psychological characteristics of entrepreneurs associated with their firms' disaster pre-

paredness. First, knowledge about climate change, in particular knowledge about the **causes** of climate change, is related to the disaster preparedness of firms. Second, descriptive norms (i.e. the extent to which a firm owner thinks that other firm owners are acting to reduce disaster risk) are linked to firms' disaster preparedness. Third, egoistic values (i.e. pursuing self-serving activities) are also linked to firms' disaster preparedness. These findings are mediated through firm owners' risk perception—that is, these socio-psychological characteristics are associated with higher risk perception, which subsequently affects disaster preparedness of firms. Moreover, these findings are stronger for bigger micro-enterprises that employ at least five workers than for smaller entities.

We find that experience with disasters relates to firms' de facto disaster preparedness. While this is important to know, it is unsustainable and potentially dangerous to wait for firms to be hit by disasters before they prepare for more disasters. They should prepare for a disaster before it hits and potentially knocks them out of the market.

In contrast to studies by van der Linden (2015) and Brosch (2021), affect is not a main predictor of disaster preparedness. In our study, the association between affect and disaster preparedness is statistically insignificant. This is important because the academic literature places a strong focus on affect and emotions related to climate change and disasters. Affect might be an essential factor in Western contexts. However, among highly vulnerable populations in a low-income setting, affect might be less relevant.

Providing information about specific disaster preparedness measures does not result in changed attitudes towards or de facto disaster preparedness of enterprises. This means that the information provided to firms might need to be more specific. Instead of just providing information about possible disaster preparedness measures, it might need to influence firm owners' knowledge about climate change, their descriptive norms, or egoistic values. For example, providing information about similar firm owners who are successfully preparing their firms for disasters, and how they do so, might be more effective than just providing information about disaster preparedness measures (Brosch 2021). Similarly, increasing firm owners' knowledge about (the causes) of climate change might prove effective. These are possible future avenues for researchers. Similarly, policy-makers can disseminate success stories of firms' disaster preparedness through local media. In the long term, policy-makers should make sure that individuals receive profound education about (the causes of) climate change. In a context of insufficient financial resources, it is crucial to think about how to make public expenditure decisions. The fact that spending money on information campaigns might not be effective is an important point to consider during public expenditure planning.

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Appendix

Table A1: Socio-psychological characteristics at baseline

	All	Min	Max	Treated	Control
Firm characteristics					
Entrepreneurial	18.267	6	21	18.04	18.431
orientation	(1.930)			(2.197)	(1.697)
Disaster experience					
Cyclone experience	1.597	0	6	1.647	1.562
	(0.593)			(1.628)	(1.568)
Floods experience	0.745	0	6	0.723	0.761
	(1.311)			(1.366)	(1.271)
Climate change knowledge					
Causes	1.497	0	4	1.427	1.548
	(1.253)			(1.190)	(1.295)
Consequences	1.403	0	4	1.323	1.460
	(1.302)			(1.269)	(1.323)
Physics	2.400	0	4	2.447	2.366
	1.554			(1.524)	(1.577)
Social Norms					
Descriptive	9.928	2	14	9.960	9.904
	(2.638)			(2.527)	(2.717)
Prescriptive	8.671	4	14	8.737	8.624
	(2.217)			(2.153)	(2.263)
Personal values					
Affect	24.171	13	28	24.117	24.211
	(2.616)			(2.728)	(2.536)
Biospheric	35.955	18	40	35.563	36.237
	(4.102)			(4.267)	(3.961)
Altruistic	35.680	13	40	35.49	35.816
	(4.315)			(4.201)	(4.395)
Egoistic	30.256	4	40	30.30	30.225
	(7.868)			(7.826)	(7.907)
Number of firms	718			300	418

Note: mean estimates. ***Significance of t-tests between treatment and control group at p$<$.01, ** p$<$.05, * p$<$.1 level. The specific survey questions are further outlined in Appendix Tables A6 and A7.
Source: authors' calculations based on MSMC data.

Table A2: Intercorrelations

	1	2	3	4	5	6	7	8	9	10	11	12
1. Entrepreneurial orientation	1.00											
2. Cyclone experience	-0.061	1.00										
3. Floods experience	-0.076	0.430	1.00									
4. CC Causes	0.064	0.014	-0.021	1.00								
5. CC Consequences	0.040	0.019	0.021	0.456	1.00							
6. CC Physics	0.065	0.069	0.011	0.474	0.403	1.00						
7. Descriptive	0.100	0.107	0.012	-0.041	-0.074	0.052	1.00					
8. Prescriptive	0.045	0.151	0.165	0.112	0.145	0.119	0.075	1.00				
9. Affect	0.125	0.109	0.118	0.048	0.122	0.048	0.037	0.387	1.00			
10. Biospheric	0.119	0.003	-0.049	0.073	0.072	0.136	0.102	0.064	0.038	1.00		
11. Altruistic	0.104	0.046	-0.018	0.025	0.045	0.101	0.122	0.034	0.036	0.566	1.00	
12. Egoistic	0.028	0.169	0.062	0.106	0.062	0.161	0.032	0.059	-0.033	0.263	0.287	1.00
Number of firms	718											

Note: correlation matrix. p$<$.01, ** p$<$.05, * p$<$.1.
Source: authors' calculations based on MSMC data.

Table A3: Summary statistics of disaster preparedness and owner characteristics at baseline—Attrition

	(1) Willingness		(2) Effectiveness		(3) Practice	
	Exit	Survivor	Exit	Survivor	Exit	Survivor
Disaster preparedness						
DP1: Strengthen windows with sheet covers or plywood held by wooden our metallic battens	3.907	3.902	4.907	4.949	0.534	0.477
DP2: Strengthen doors with wooden or metallic crossbars fixed to the wall	3.910	3.942	4.926	4.995	0.475	0.504
DP3: Strengthen roof between beams with metallic strings or straps	3.869	3.957	4.891	4.955	0.577	0.541
DP4: Strengthen roof with more nails	3.993	4.143*	5.051	5.227	0.703	0.660
DP5: Elevate material	3.671	3.674	5.065	4.978	0.587	0.552
DP6: Plant trees	3.219	3.287	4.535	4.596	0.355	0.386
DP7: Protection wall	3.400	3.462	4.839	4.887	0.290	0.334
DP8: Use sand sacks	3.368	3.421	4.387	4.657	0.458	0.487
DP9: In collaboration with neighbours - clean neighbourhoods drainage canals	3.903	3.806	5.361	5.350	0.613	0.578
DP10: Change location	2.948	2.890	3.929	3.866	0.226	0.203
Index of 4 measures in pictures	13.026	13.569	16.432	17.124	1.916	1.866
Index of 6 measures NOT in pictures	20.510	20.540	28.116	28.334	2.529	2.540
Index combining all 10 measures	33.535	34.110	44.548	45.458	4.445	4.407
Number of firms	155	718	155	718	155	718
Owner characteristics						
Province						
Maputo	0.290	0.376**				
Gaza	0.045	0.046				
Sofala	0.303	0.260				
Manica	0.323	0.234**				
Nampula	0.019	0.043				
Tete	0.019	0.040				
Female	0.116	0.123				
Sectors						
Food processor	0.123	0.128				
Tailor	0.206	0.201				
Carpenter	0.316	0.325				
Printing	0.019	0.024				
Chemicals	0.000	0.004				
Brick maker	0.116	0.068**				
Black smith	0.135	0.182				
High tech	0.000	0.001				
Other	0.084	0.067				
Firm size	3.497	3.380				
Formality indicators						
Municipality	0.406	0.422				
One-stop shop (BAÚ)	0.103	0.178**				
Social security (INSS)	0.108	0.159				
Risk perception						
CC risk perception	45.316	45.077				
Cyclone risk perception	46.568	45.939				
Flood risk perception	45.994	45.506				
Number of firms	155	718				

Note: mean estimates. ***Significance of t-tests between treatment and control group at p<.01, ** p<.05, * p<.1 level. The specific survey questions are further outlined in the Appendix Tables A6 and A7.
(1) On a scale from 1 (fully unwilling) to 5 (highly willing), how willing are you to implement the following measure. (2) On a scale from 1 (fully inefficient) to 7 (highly efficient), how do you evaluate the efficiency of the following measure. (3) Binary variable if the firm has ever applied this measure in the past.
Source: authors' calculations based on IIM 2022 Information Treatment data.

Table A4: Factors explaining disaster preparedness—OLS

	Willingness					Effectiveness					Practice				
	DP4	DP10	Pictures	No Pictures	All	DP4	DP10	Pictures	No Pictures	All	DP4	DP10	Pictures	No Pictures	All
Treatment	0.060	0.079	-0.028	-0.016	-0.030	0.035	0.012	-0.021	-0.030	-0.032	0.037	0.092	0.011	0.043	0.032
	(0.082)	(0.078)	(0.077)	(0.072)	(0.072)	(0.078)	(0.075)	(0.076)	(0.068)	(0.070)	(0.078)	(0.073)	(0.072)	(0.069)	(0.068)
Firm characteristics															
Entrepreneurial orientation	0.016	0.007	0.076***	0.072***	0.095***	0.083***	0.028	0.101***	0.081***	0.117***	0.037	0.063**	0.084***	0.086***	0.100***
	(0.031)	(0.027)	(0.027)	(0.027)	(0.028)	(0.030)	(0.023)	(0.028)	(0.026)	(0.028)	(0.029)	(0.028)	(0.027)	(0.027)	(0.027)
Disaster experience	0.049*	0.094***	0.017	0.135***	0.080***	0.060**	0.067**	0.006	0.088***	0.053**	0.168***	0.115***	0.162***	0.166***	0.193***
	(0.029)	(0.028)	(0.029)	(0.027)	(0.027)	(0.029)	(0.027)	(0.029)	(0.025)	(0.027)	(0.028)	(0.027)	(0.027)	(0.025)	(0.025)
Climate change knowledge	0.020	0.026	0.020	0.038	0.035	0.042	0.060**	0.016	0.072***	0.051*	0.066**	0.115***	0.073***	0.072***	0.085***
	(0.028)	(0.027)	(0.028)	(0.026)	(0.027)	(0.028)	(0.027)	(0.028)	(0.027)	(0.027)	(0.029)	(0.027)	(0.027)	(0.026)	(0.026)
Social norms															
Descriptive	0.119***	0.148***	0.101***	0.192***	0.173***	0.013	0.117***	0.056*	0.077***	0.083***	0.071	0.124***	0.143***	0.181***	0.191***
	(0.030)	(0.030)	(0.031)	(0.029)	(0.030)	(0.029)	(0.029)	(0.031)	(0.028)	(0.030)	(0.031)	(0.030)	(0.028)	(0.027)	(0.026)
Prescriptive	-0.025	-0.090***	-0.054*	-0.064**	-0.073**	-0.010	-0.111***	-0.057*	-0.112***	-0.102***	0.062**	-0.125***	0.011	-0.002	0.006
	(0.029)	(0.027)	(0.030)	(0.030)	(0.027)	(0.029)	(0.028)	(0.030)	(0.028)	(0.030)	(0.028)	(0.027)	(0.028)	(0.027)	(0.027)
Personal values															
Affect	0.011	-0.052*	-0.005	0.008	0.001	0.053	-0.004	0.014	0.092***	0.061**	-0.016	-0.094***	-0.044*	-0.043	-0.051*
	(0.032)	(0.028)	(0.027)	(0.030)	(0.028)	(0.034)	(0.028)	(0.027)	(0.029)	(0.028)	(0.030)	(0.027)	(0.027)	(0.027)	(0.026)
Biospheric	0.004	-0.004	0.014	0.021	0.021	-0.033	-0.053	-0.007	-0.023	-0.017	-0.019	-0.039	-0.021	-0.023	-0.026
	(0.031)	(0.033)	(0.031)	(0.030)	(0.031)	(0.035)	(0.032)	(0.030)	(0.030)	(0.030)	(0.034)	(0.032)	(0.030)	(0.030)	(0.029)
Altruistic	-0.086***	-0.120***	-0.046	-0.077**	-0.073**	-0.089***	-0.119***	-0.042	-0.101***	-0.086***	-0.065*	-0.010	-0.085***	-0.036	-0.072**
	(0.031)	(0.034)	(0.030)	(0.030)	(0.030)	(0.032)	(0.034)	(0.031)	(0.031)	(0.031)	(0.033)	(0.032)	(0.030)	(0.031)	(0.029)
Egoistic	0.039	0.091***	0.019	0.013	0.021	0.074**	0.139***	0.051	0.074***	0.078**	0.114***	0.044	0.127***	0.050*	0.105***
	(0.029)	(0.028)	(0.029)	(0.029)	(0.030)	(0.031)	(0.029)	(0.030)	(0.029)	(0.030)	(0.031)	(0.028)	(0.026)	(0.028)	(0.026)
Number of firms	1,273	1,436	1,436	1,436	1,436	1,273	1,436	1,436	1,436	1,436	1,273	1,436	1,436	1,436	1,436
R2	0.033	0.055	0.025	0.073	0.059	0.036	0.060	0.026	0.068	0.062	0.077	0.067	0.111	0.097	0.141

Note: mean estimates.
Source: authors' calculations based on MSMC data.

Table A5: Summary statistics of firm and owner characteristics at baseline—Pictures seen vs not seen before

		Pictures	
	All	Seen	Not seen
Province			
Maputo	0.376	0.326	0.417
Gaza	0.046	0.037	0.035
Sofala	0.260	0.289	0.226
Manica	0.234	0.292	0.191
Nampula	0.043	0.022	0.043
Tete	0.040	0.039	0.086*
Female	0.123	0.134	0.104
Sectors			
Food processor	0.128	0.146	0.113
Tailor	0.201	0.230	0.243
Carpenter	0.325	0.287	0.304
Printing	0.024	0.011	0.026
Chemicals	0.004	0.005	0.000
Brick maker	0.068	0.039	0.043
Black smith	0.182	0.247	0.200
High tech	0.001	0.006	0.000
Other	0.067	0.028	0.070*
Firm size	3.380	3.045	3.096
Formality indicators			
Municipality	0.422	0.320	0.313
One-stop shop (BAÚ)	0.178	0.174	0.148
Social security (INSS)	0.028	0.152	0.125
Risk perception			
CC risk perception	45.077	45.427	44.574
Cyclone risk perception	45.939	45.989	45.617
Flood risk perception	45.506	45.427	45.209
Number of firms	718	178	115

Note: mean estimates. ***Significance of t-tests between treatment and control group at p$<$.01, ** p$<$.05, * p$<$.1 level. The specific survey questions are further outlined in the Appendix Tables A6 and A7.
Source: authors' calculations based on MSMC data.

Table A6: Questionnaire—Dependent variables (disaster preparedness)

Variable	Description	Reply options
Willingness	Are you willing to apply [MEASURE]	Completely unwilling, Unwilling Undecided, Willing to apply, Highly willing to apply Not applicable (We do not have a roof/windows/etc.)
Effectiveness	Evaluate the effectiveness for your enterprise of the following measure [MEASURE]	Completely ineffective, Ineffective Undecided, A bit efficient, efficient Highly efficient, extremely efficient
Practice	Have you, at some point in the past, applied [MEASURE]	Many times, A few times, One time, Never
MEASURES		
DP1	Strengthen windows with sheet covers or plywood held by wooden or metallic battens	
DP2	Strengthen doors with wooden or metallic crossbars fixed to the wall	
DP3	Strengthen roof between beams with metallic strings or straps	
DP4	Strengthen fixation of roof with a higher number of nails	
DP5	Put enterprise's goods to more elevated places	
DP6	Plant trees around the enterprise	
DP7	Construct a protection wall	
DP8	Use sand backs	
DP9	Take trash out of the drainage canal in a joint effort with the neighbors of the enterprise‘s neighborhood	
DP10	Move the enterprise to a different location	

Source: authors' MSMC survey questionnaire.

Table A7: Questionnaire—Explanatory variables

Variable	Description	Reply options
Firm characteristics		
Entrepreneurial orientation	Index combining three variables: 'I have innovative ideas', 'If something cannot be done, I find a way', 'Many times, I find more than one solution to a problem'	Completely wrong, Wrong, Slightly wrong, Undecided, Slightly correct, correct, Completely correct
Disaster experience	In the past five years, how many times did the LOCATION of your ENTERPRISE experience [a cyclone/floods/an earth quake]	Never, Once, Twice Three times, Four times Five times, Six or more times
CC knowledge	Indices	
Physical	'Burning petrol produces Carbon Dioxide (CO2)', 'Carbon Dioxide (CO2) is harmful to plants' 'At the same quantity, carbon dioxide (CO2) is more harmful to the environment than methane'	Correct, Incorrect, Don't know
Causes	Index of four variables: 'The global concentration of CO2 in the atmosphere has increased in the past 250 years', 'Climate change is principally caused by human activity', 'The global temperature increase in the last century (1900-1999) was the largest in the past thousand years', 'The global CO2 concentration in the atmosphere today already occurred during the past 650 thousand years',	Correct, Incorrect Don't know
Consequences	Index of four variables: 'For the next decades, scientists expect for a hotter climate to melt the polar ice, and this will increase the sea level', 'For the next decades, scientists expect an increase in extreme events such as droughts, floods and cyclones', 'For the next decades, scientists expect for a hotter climate to increase the evaporation of water, and this will reduce the sea level', 'For the next decades, scientists expect for the climate to change uniformly around the world',	Correct, Incorrect Don't know
Values	In the following questions, will read a value or principle.	The interviewee should reply with a number on a scale from 1 to 7
Affect	'I see [climate change/cyclones/floods] as something that is...'	1=very pleasant, ... 7=very unpleasant
	'Overall, I feel that [climate change/cyclones/floods] is something...'	1=very favorable, ... 7=very unfavorable
	'To me, [climate change/cyclones/floods] is something...'	1=very positive, ... 7=very negative
Descriptive	Index of 'Other businesses are applying changes to their buildings and/or operations to better prepare for changing weather (i.e. storms or floods)', 'How likely is it that other businesses ...that are similar to yours are applying 'changes to their buildings and/or operations to better prepare for changing weather (i.e. storms or floods)	1=strongly disagree, ... 7=strongly agree 1=very unlikely, ..., 7=very likely
Prescriptive	Index of 'It is generally expected of me that I prepare my business for the risk of changing weather (i.e. storms or floods) 'I feel that preparing my business for the risk of changing weather (i.e. storms or floods) is something that is NOT expected of me'	1=strongly disagree, ... 7=strongly agree 1=strongly agree, ... 7=strongly disagree
Biospheric	Index of 'Respect the earth (harmony with other species)', 'Protect the environment (preserve nature)', 'Prevent pollution (protect natural resources)', 'Unity with nature (Fit into nature)'	
Socio-altruistic	Index of 'A world in peace: Free of war and conflict', 'Equality: Equality of opportunity for all', 'Being of help: Work for the well-being of others', 'Social justice: Correct injustice, take care of the weak'	
Egoistic	Index of 'Authority: The right to lead or command', 'Influence: have an impact on others and events', 'Social power: Control over people, dominance', 'Richness: Material goods, money'	

Source: authors' IIM survey questionnaire.

A Heterogeneity

Table A8: Information and disaster preparedness—No disaster experience vs disaster experience

	No disaster experience			Disaster experience		
	Willingness	Effectiveness	Practice	Willingness	Effectiveness	Practice
DP1: Strengthen windows with sheet covers or plywood	0.164	-0.151	0.517*	-0.007	0.117	-0.095
	(0.210)	(0.201)	(0.217)	(0.151)	(0.151)	(0.146)
Observations	346	346	346	743	743	743
DP2: Strengthen doors with wooden or metallic	-0.208	-0.208	0.250	-0.013	-0.063	-0.054
crossbars fixed to the wall	(0.199)	(0.206)	(0.220)	(0.149)	(0.147)	(0.139)
Number of firms	362	362	362	776	776	776
DP3: Strengthen roof between beams	-0.249	-0.242	0.009	0.080	0.141	0.098
with metallic strings or straps	(0.235)	(0.220)	(0.220)	(0.131)	(0.134)	(0.129)
Number of firms	372	372	372	888	888	888
DP4: Strengthen roof with more nails	0.070	-0.107	0.091	-0.028	0.014	0.096
	(0.217)	(0.195)	(0.232)	(0.131)	(0.137)	(0.126)
Number of firms	376	376	376	897	897	897
DP5: Elevate material	0.037	-0.081	0.015	0.068	0.071	0.097
	(0.198)	(0.194)	(0.201)	(0.126)	(0.128)	(0.126)
Number of firms	436	436	436	1000	1000	1000
DP6: In collaboration with neighbours	-0.198	-0.354	0.209	-0.150	-0.101	-0.080
clean neighbourhoods drainage canals	(0.210)	(0.190)	(0.208)	(0.123)	(0.128)	(0.128)
Number of firms	436	436	436	1000	1000	1000
Index of 6 measures	-0.085	-0.207	0.171	-0.076	-0.055	0.004
in pictures	(0.199)	(0.199)	(0.195)	(0.128)	(0.127)	(0.124)
Number of firms	436	436	436	1000	1000	1000
DP7: Protection wall	-0.198	-0.354	0.209	-0.150	-0.101	-0.0796
	(0.210)	(0.190)	(0.208)	(0.123)	(0.128)	(0.128)
Number of firms	436	436	436	1000	1000	1000
DP8: Use sand sacks	-0.317	-0.249	0.303	-0.047	-0.046	-0.127
	(0.209)	(0.185)	(0.196)	(0.124)	(0.130)	(0.127)
Number of firms	436	436	436	1000	1000	1000
DP9: Plant trees	-0.159	-0.161	0.015	-0.066	0.043	0.016
	(0.208)	(0.194)	(0.196)	(0.124)	(0.126)	(0.130)
Number of firms	436	436	436	1000	1000	1000
DP10: Change location	-0.325	-0.341	0.150	0.095	0.073	0.167
	(0.196)	(0.189)	(0.167)	(0.128)	(0.130)	(0.138)
Number of firms	436	436	436	1000	1000	1000
Index of 4 measures	-0.369	-0.408*	0.214	-0.061	-0.006	0.014
NOT in pictures	(0.209)	(0.175)	(0.182)	(0.123)	(0.132)	(0.133)
Number of firms	436	436	436	1000	1000	1000
Index combining	-0.237	-0.346	0.246	-0.108	-0.046	-0.008
all 10 measures	(0.203)	(0.194)	(0.191)	(0.126)	(0.127)	(0.127)
Number of firms	436	436	436	1000	1000	1000

Note: mean estimates.
Source: authors' calculations based on MSMC data.

Table A9: Information and disaster preparedness—Low CC knowledge vs high CC knowledge

	Low CC knowledge			High CC knowledge		
	Willingness	Effectiveness	Practice	Willingness	Effectiveness	Practice
DP1: Strengthen windows with sheet covers or plywood	-0.0003	0.028	-0.004	0.094	0.069	0.165
	(0.166)	(0.165)	(0.158)	(0.174)	(0.175)	(0.188)
Observations	637	637	637	452	452	452
DP2: Strengthen doors with wooden or metallic	-0.010	-0.070	-0.024	-0.220	-0.206	0.119
crossbars fixed to the wall	(0.161)	(0.162)	(0.154)	(0.174)	(0.174)	(0.178)
Number of firms	667	667	667	471	471	471
DP3: Strengthen roof between beams	0.076	0.050	-0.079	-0.136	-0.004	0.303
with metallic strings or straps	(0.151)	(0.153)	(0.147)	(0.174)	(0.168)	(0.168)
Number of firms	740	740	740	520	520	520
DP4: Strengthen roof with more nails	0.091	-0.100	0.148	-0.0999	0.0740	0.011
	(0.150)	(0.146)	(0.150)	(0.170)	(0.181)	(0.170)
Number of firms	747	747	747	526	526	526
DP5: Elevate material	-0.018	-0.113	0.063	0.142	0.139	0.098
	(0.143)	(0.144)	(0.140)	(0.155)	(0.155)	(0.164)
Number of firms	830	830	830	606	606	606
DP6: In collaboration with neighbours	-0.317*	-0.145	0.007	0.119	0.019	0.086
clean neighbourhoods drainage canals	(0.143)	(0.137)	(0.141)	(0.155)	(0.163)	(0.165)
Number of firms	830	830	830	606	606	606
Index of 6 measures	-0.209	-0.263	-0.0699	0.014	0.040	0.179
in pictures	(0.137)	(0.136)	(0.136)	(0.168)	(0.169)	(0.165)
Number of firms	830	830	830	606	606	606
	(0.137)	(0.136)	(0.136)	(0.168)	(0.169)	(0.165)
DP7: Protection wall	-0.191	-0.131	-0.025	-0.159	-0.277	-0.025
	(0.144)	(0.141)	(0.138)	(0.156)	(0.159)	(0.169)
Number of firms	830	830	830	606	606	606
DP8: Use sand sacks	-0.259	-0.261	-0.010	0.035	0.031	0.011
	(0.143)	(0.141)	(0.140)	(0.156)	(0.158)	(0.165)
Number of firms	830	830	830	606	606	606
DP9: Plant trees	-0.113	0.038	0.030	-0.075	-0.138	-0.036
	(0.143)	(0.139)	(0.138)	(0.158)	(0.162)	(0.167)
Number of firms	830	830	830	606	606	606
DP10: Change location	-0.005	-0.008	0.174	-0.040	-0.081	0.153
	(0.143)	(0.142)	(0.132)	(0.160)	(0.161)	(0.175)
Number of firms	830	830	830	606	606	606
Index of 4 measures	-0.205	-0.124	0.050	-0.092	-0.173	0.057
NOT in pictures	(0.140)	(0.137)	(0.133)	(0.160)	(0.164)	(0.173)
Number of firms	830	830	830	606	606	606
Index combining	-0.283*	-0.264*	-0.027	-0.026	-0.045	0.146
all 10 measures	(0.136)	(0.134)	(0.131)	(0.165)	(0.169)	(0.172)
Number of firms	830	830	830	606	606	606

Note: mean estimates.
Source: authors' calculations based on MSMC data.

Table A10: Information and disaster preparedness—Low descriptive norms vs high descriptive norms

	Low descriptive norms			High descriptive norms		
	Willingness	Effectiveness	Practice	Willingness	Effectiveness	Practice
DP1: Strengthen windows with sheet covers or plywood	-0.127	-0.049	0.0004	0.179	0.116	0.102
	(0.177)	(0.183)	(0.171)	(0.166)	(0.158)	(0.164)
Observations	507	507	507	582	582	582
DP2: Strengthen doors with wooden or metallic	-0.379*	-0.221	-0.055	0.152	-0.046	0.106
crossbars fixed to the wall	(0.171)	(0.177)	(0.168)	(0.163)	(0.159)	(0.157)
Number of firms	532	532	532	606	606	606
DP3: Strengthen roof between beams	-0.269	-0.204	0.112	0.221	0.234	0.0758
with metallic strings or straps	(0.174)	(0.175)	(0.168)	(0.147)	(0.147)	(0.145)
Number of firms	574	574	574	686	686	686
DP4: Strengthen roof with more nails	-0.152	-0.176	0.101	0.156	0.103	0.101
	(0.173)	(0.173)	(0.175)	(0.145)	(0.149)	(0.141)
Number of firms	583	583	583	690	690	690
DP5: Elevate material	0.074	0.027	0.190	0.044	-0.021	0.006
	(0.161)	(0.160)	(0.156)	(0.138)	(0.141)	(0.142)
Number of firms	674	674	674	762	762	762
DP6: In collaboration with neighbours	-0.318	-0.160	0.067	0.041	0.008	0.042
clean neighbourhoods drainage canals	(0.162)	(0.155)	(0.158)	(0.137)	(0.142)	(0.144)
Number of firms	674	674	674	762	762	762
Index of 6 measures	-0.228	-0.227	0.081	-0.002	-0.038	0.037
in pictures	(0.156)	(0.158)	(0.148)	(0.142)	(0.141)	(0.141)
Number of firms	674	674	674	762	762	762
DP7: Protection wall	-0.342*	-0.423**	-0.098	-0.022	0.021	0.067
	(0.163)	(0.160)	(0.156)	(0.137)	(0.138)	(0.147)
Number of firms	674	674	674	762	762	762
DP8: Use sand sacks	-0.363*	-0.405**	0.079	0.080	0.115	-0.046
	(0.159)	(0.155)	(0.153)	(0.138)	(0.142)	(0.143)
Number of firms	674	674	674	762	762	762
DP9: Plant trees	-0.102	-0.059	0.111	-0.088	-0.009	-0.07
	(0.160)	(0.158)	(0.151)	(0.141)	(0.142)	(0.149)
Number of firms	674	674	674	762	762	762
DP10: Change location	-0.061	-0.087	0.133	0.036	0.024	0.221
	(0.155)	(0.156)	(0.138)	(0.143)	(0.144)	(0.157)
Number of firms	674	674	674	762	762	762
Index of 4 measures	-0.314*	-0.344*	0.097	-0.001	0.052	0.059
NOT in pictures	(0.150)	(0.152)	(0.144)	(0.142)	(0.143)	(0.148)
Number of firms	674	674	674	762	762	762
Index combining	-0.363*	-0.334*	0.098	0.010	-0.007	0.050
all 10 measures	(0.150)	(0.151)	(0.143)	(0.143)	(0.144)	(0.143)
Number of firms	674	674	674	762	762	762

Note: mean estimates.
Source: authors' calculations based on MSMC data.

Table A11: Information and disaster preparedness—Low egoistic values vs high egoistic values

	Low egoistic norms			High egoistic norms		
	Willingness	Effectiveness	Practice	Willingness	Effectiveness	Practice
DP1: Strengthen windows with sheet covers or plywood	0.115	0.243	0.216	-0.027	-0.130	-0.044
	(0.176)	(0.176)	(0.169)	(0.170)	(0.167)	(0.170)
Observations	531	531	531	558	558	558
DP2: Strengthen doors with wooden or metallic	0.032	0.055	0.138	-0.202	-0.282	-0.030
crossbars fixed to the wall	(0.170)	(0.177)	(0.167)	(0.167)	(0.161)	(0.163)
Number of firms	563	563	563	575	575	575
DP3: Strengthen roof between beams	0.102	-0.021	0.156	-0.091	0.092	0.055
with metallic strings or straps	(0.172)	(0.170)	(0.160)	(0.152)	(0.153)	(0.152)
Number of firms	601	601	601	659	659	659
DP4: Strengthen roof with more nails	0.019	-0.059	0.228	0.020	0.022	0.001
	(0.169)	(0.168)	(0.166)	(0.151)	(0.154)	(0.151)
Number of firms	612	612	612	661	661	661
DP5: Elevate material	0.080	0.081	0.094	0.034	-0.082	0.087
	(0.156)	(0.156)	(0.153)	(0.144)	(0.146)	(0.148)
Number of firms	702	702	702	734	734	734
DP6: In collaboration with neighbours	-0.274	-0.267	-0.068	0.007	0.109	0.156
clean neighbourhoods drainage canals	(0.155)	(0.157)	(0.155)	(0.144)	(0.141)	(0.148)
Number of firms	702	702	702	734	734	734
Index of 6 measures	-0.033	-0.087	0.126	-0.176	-0.162	-0.008
in pictures	(0.156)	(0.155)	(0.147)	(0.145)	(0.144)	(0.149)
Number of firms	702	702	734	734	734	
DP7: Protection wall	-0.147	0.012	-0.0006	-0.207	-0.377*	-0.0276
	(0.157)	(0.154)	(0.156)	(0.144)	(0.146)	(0.148)
Number of firms	702	702	702	734	734	734
DP8: Use sand sacks	-0.182	-0.281	0.050	-0.082	0.008	-0.029
	(0.152)	(0.153)	(0.153)	(0.147)	(0.146)	(0.148)
Number of firms	702	702	702	734	734	734
DP9: Plant trees	-0.112	-0.121	-0.0882	-0.0854	0.0423	0.106
	(0.154)	(0.154)	(0.153)	(0.148)	(0.146)	(0.150)
Number of firms	702	702	702	734	734	734
DP10: Change location	-0.121	-0.102	0.178	0.092	0.043	0.178
	(0.152)	(0.154)	(0.146)	(0.148)	(0.146)	(0.154)
Number of firms	702	702	702	734	734	734
Index of 4 measures	-0.207	-0.178	0.012	-0.102	-0.098	0.124
NOT in pictures	(0.148)	(0.150)	(0.148)	(0.150)	(0.149)	(0.153)
Number of firms	702	702	702	734	734	734
Index combining	-0.149	-0.149	0.112	-0.181	-0.172	0.039
all 10 measures	(0.154)	(0.155)	(0.145)	(0.145)	(0.144)	(0.151)
Number of firms	702	702	702	734	734	734

Note: mean estimates.
Source: authors' calculations based on MSMC data.

B Robustness

Table A12: Socio-psychological characteristics and disaster preparedness—Representative sample

	Willingness					Effectiveness					Practice				
	DP4	DP10	Pictures	No Pictures	All	DP4	DP10	Pictures	No Pictures	All	DP4	DP10	Pictures	No Pictures	All
Firm characteristics															
Entrepreneurial	-0.028	0.001	0.019	0.057	0.043	0.055	-0.047	0.034	0.075*	0.065	0.072	0.046	0.045	0.050	0.056
orientation	(0.048)	(0.040)	(0.043)	(0.040)	(0.041)	(0.048)	(0.041)	(0.043)	(0.041)	(0.041)	(0.049)	(0.045)	(0.041)	(0.043)	(0.041)
Disaster	-0.021	-0.078	-0.083	0.000	-0.064	0.010	-0.053	-0.097*	-0.029	-0.087	0.109*	0.146**	0.056	0.172***	0.134**
experience	(0.061)	(0.053)	(0.057)	(0.052)	(0.054)	(0.061)	(0.055)	(0.057)	(0.054)	(0.053)	(0.062)	(0.059)	(0.054)	(0.057)	(0.054)
Climate change	0.009	-0.032	0.079*	0.012	0.067	0.066	0.043	0.090**	0.099**	0.119***	0.069	0.162***	0.106**	0.132***	0.140***
knowledge	(0.047)	(0.040)	(0.043)	(0.040)	(0.041)	(0.048)	(0.042)	(0.043)	(0.041)	(0.041)	(0.048)	(0.045)	(0.041)	(0.043)	(0.041)
Social norms															
Descriptive	0.088*	0.212***	0.094**	0.180***	0.161***	0.017	0.214***	0.047	0.103**	0.090**	0.033	0.149***	0.106**	0.168***	0.161***
	(0.048)	(0.041)	(0.044)	(0.041)	(0.042)	(0.048)	(0.043)	(0.044)	(0.042)	(0.042)	(0.049)	(0.046)	(0.042)	(0.044)	(0.042)
Prescriptive	0.027	-0.062	-0.064	-0.039	-0.069	0.019	-0.116***	-0.060	-0.102**	-0.100**	0.086*	-0.133***	0.027	0.004	0.018
	(0.049)	(0.041)	(0.044)	(0.041)	(0.042)	(0.050)	(0.042)	(0.044)	(0.042)	(0.042)	(0.050)	(0.046)	(0.042)	(0.044)	(0.042)
Personal values															
Affect	-0.015	0.007	-0.001	0.016	0.007	0.043	0.034	0.030	0.086**	0.069*	-0.065	-0.044	-0.035	-0.021	-0.033
	(0.044)	(0.037)	(0.040)	(0.037)	(0.038)	(0.045)	(0.038)	(0.040)	(0.038)	(0.037)	(0.045)	(0.041)	(0.038)	(0.040)	(0.038)
Biospheric	0.022	0.027	0.106**	0.012	0.087*	-0.015	0.005	0.084*	-0.033	0.043	0.014	-0.055	0.031	-0.015	0.010
	(0.052)	(0.045)	(0.048)	(0.045)	(0.046)	(0.053)	(0.047)	(0.049)	(0.046)	(0.046)	(0.053)	(0.050)	(0.046)	(0.048)	(0.046)
Altruistic	-0.087*	-0.103**	-0.064	-0.059	-0.079*	-0.097*	-0.179***	-0.075	-0.163***	-0.143***	-0.039	-0.024	-0.038	-0.007	-0.026
	(0.053)	(0.046)	(0.049)	(0.046)	(0.047)	(0.053)	(0.048)	(0.050)	(0.047)	(0.047)	(0.054)	(0.051)	(0.047)	(0.049)	(0.047)
Egoistic	0.086*	0.061	-0.026	0.014	-0.013	0.106**	0.157***	0.024	0.133***	0.090**	0.090*	0.002	0.095**	0.062	0.093**
	(0.050)	(0.042)	(0.045)	(0.041)	(0.042)	(0.051)	(0.043)	(0.045)	(0.043)	(0.042)	(0.051)	(0.046)	(0.043)	(0.045)	(0.043)
Number of firms	1,026	1,162	1,162	1,162	1,162	1,026	1,162	1,162	1,162	1,162	1,026	1,162	1,162	1,162	1,162
R2	0.021	0.008	0.001	0.086	0.023	0.024	0.025	0.000	0.070	0.038	0.091	0.063	0.106	0.105	0.156

Note: mean estimates.
Source: authors' calculations based on MSMC data.

Table A13: Information and disaster preparedness—Representative sample

	Willingness	Effectiveness	Usage
DP1: Strengthen windows with sheet	-0.003	0.008	-0.024
covers or plywood	(0.134)	(0.133)	(0.136)
Observations	869	869	869
DP2: Strengthen doors with wooden or metallic	-0.058	-0.135	-0.014
crossbars fixed to the wall	(0.131)	(0.133)	(0.132)
Observations	908	908	908
DP3: Strengthen roof between beams	0.026	0.029	0.076
with metallic strings or straps	(0.126)	(0.125)	(0.124)
Observations	1019	1019	1019
DP4: Strengthen roof with more nails	0.041	0.015	0.091
	(0.124)	(0.124)	(0.126)
Observations	1026	1026	1026
DP5: Elevate material	0.083	0.042	0.068
	(0.112)	(0.115)	(0.118)
Observations	1162	1162	1162
DP6: Plant trees	-0.058	0.007	0.013
	(0.117)	(0.118)	(0.118)
Observations	1162	1162	1162
DP7: Protection wall	-0.194	-0.184	0.040
	(0.116)	(0.118)	(0.119)
Observations	1162	1162	1162
DP8: Use sand sacks	-0.094	-0.043	0.104
	(0.116)	(0.113)	(0.118)
Observations	1162	1162	1162
DP9: In collaboration with neighbours	-0.017	0.012	0.067
clean neighbourhoods drainage canals	(0.113)	(0.115)	(0.118)
Observations	1162	1162	1162
DP10: Change location	0.007	0.012	0.231
	(0.116)	(0.117)	(0.120)
Observations	1162	1162	1162
Disaster preparedness	-0.073	-0.062	0.095
index	(0.117)	(0.117)	(0.118)
Observations	1162	1162	1162

Note: mean estimates.
Source: authors' calculations based on MSMC data.

Table A14: Information and disaster preparedness—Pictures seen before vs. not seen before

	Willingness		Effectiveness		Usage	
	Seen	Not seen	Seen	Not seen	Seen	Not seen
DP1: Strengthen windows with sheet	-0.006	0.117	-0.004	0.0699	-0.081	0.277
covers or plywood	(0.142)	(0.172)	(0.147)	(0.162)	(0.145)	(0.167)
Observations	905	810	905	810	905	810
DP2: Strengthen doors with wooden or metallic	-0.176	0.0144	-0.193	-0.096	-0.052	0.178
crossbars fixed to the wall	(0.137)	(0.169)	(0.139)	(0.172)	(0.139)	(0.164)
Observations	947	843	947	843	947	843
DP3: Strengthen roof between beams	0.074	-0.169	0.043	-0.019	0.011	0.165
with metallic strings or straps	(0.133)	(0.161)	(0.132)	(0.165)	(0.131)	(0.156)
Observations	1045	932	1045	932	1045	932
DP4: Strengthen roof with more nails	0.074	-0.093	0.016	-0.122	0.007	0.225
	(0.129)	(0.159)	(0.131)	(0.164)	(0.131)	(0.159)
Observations	1,057	942	1,057	942	1,057	942
DP5: Elevate material	0.056	-0.008	0.119	-0.215	-0.002	0.150
	(0.119)	(0.152)	(0.123)	(0.152)	(0.127)	(0.147)
Observations	1192	1066	1192	1066	1192	1066
DP6: Plant trees	-0.072	-0.145	0.011	-0.111	-0.071	0.0952
	(0.126)	(0.147)	(0.128)	(0.137)	(0.127)	(0.149)
Observations	1192	1066	1192	1066	1192	1066
DP7: Protection wall	-0.167	-0.209	-0.121	-0.338*	-0.171	0.187
	(0.122)	(0.151)	(0.127)	(0.142)	(0.125)	(0.152)
Observations	1192	1066	1192	1066	1192	1066
DP8: Use sand sacks	-0.081	-0.245	-0.051	-0.295*	-0.004	0.0004
	(0.123)	(0.145)	(0.125)	(0.140)	(0.126)	(0.149)
Observations	1192	1066	1192	1066	1192	1066
DP9: In collaboration with neighbours	-0.200	-0.0844	-0.189	0.0102	-0.042	0.173
clean neighbourhoods drainage canals	(0.121)	(0.152)	(0.125)	(0.145)	(0.127)	(0.149)
Observations	1192	1066	1192	1066	1192	1066
DP10: Change location	-0.042	-0.015	-0.054	-0.046	0.026	0.344*
	(0.125)	(0.151)	(0.126)	(0.148)	(0.131)	(0.136)
Observations	1192	1066	1192	1066	1192	1066
Pictures	-0.135	-0.182	-0.150	-0.188	-0.0998	0.129
index	(0.124)	(0.149)	(0.124)	(0.150)	(0.125)	(0.147)
Number of firms	1192	1066	1192	1066	1192	1066
No pictures	-0.149	-0.211	-0.081	-0.280*	-0.084	0.278*
index	(0.127)	(0.135)	(0.129)	(0.132)	(0.130)	(0.138)
Number of firms	1192	1066	1192	1066	1192	1066
Disaster preparedness	-0.178	-0.244	-0.153	-0.290*	-0.109	0.239
index	(0.125)	(0.143)	(0.124)	(0.144)	(0.128)	(0.142)
Observations	1192	1066	1192	1066	1192	1066

Note: mean estimates.
Source: authors' calculations based on MSMC data.

Table A15: Socio-psychological characteristics and disaster preparedness—Firm owners vs managers

	Willingness		Effectiveness		Practice	
	Owner	Manager	Owner	Manager	Owner	Manager
Firm characteristics						
Entrepreneurial	0.043	-0.008	0.026	0.087	0.068	0.019
Orientation	(0.044)	(0.070)	(0.045)	(0.066)	(0.042)	(0.074)
Disaster	-0.018	0.027	-0.075	-0.009	0.150***	0.154*
experience	(0.060)	(0.085)	(0.061)	(0.081)	(0.056)	(0.090)
Climate change	0.098**	0.043	0.135***	0.084	0.150***	0.127
knowledge	(0.044)	(0.074)	(0.045)	(0.071)	(0.056)	(0.079)
Social norms						
Descriptive	0.130***	0.113	0.050	0.066	0.169***	0.146*
	(0.045)	(0.074)	(0.046)	(0.071)	(0.043)	(0.079)
Prescriptive	-0.048	-0.055	-0.069	-0.112*	0.030	-0.015
	(0.046)	(0.069)	(0.046)	(0.066)	(0.043)	(0.074)
Personal values						
Affect	0.016	0.087	0.068	0.136**	-0.052	0.006
	(0.044)	(0.060)	(0.044)	(0.057)	(0.041)	(0.064)
Biospheric	0.050	-0.023	0.020	-0.049	0.032	-0.180*
	(0.049)	(0.088)	(0.049)	(0.084)	(0.046)	(0.094)
Altruistic	0.006	0.017	-0.131**	-0.042	-0.015	-0.000
	(0.044)	(0.069)	(0.055)	(0.066)	(0.051)	(0.074)
Egoistic	0.006	-0.008	0.095**	0.073	0.074*	0.232***
	(0.044)	(0.068)	(0.045)	(0.065)	(0.041)	(0.073)
Number of firms	1,048	388	1,048	388	1,048	388
R2	0.028	0.087	0.003	0.119	0.129	0.123

Note: Note: mean estimates including firm and time fixed effects. The sample of managers includes 15 observations that are employees such as HR-representatives or accountants instead of managers.
Source: authors' calculations based on MSMC data.

Table A16: Information and disaster preparedness—Firm owners vs managers

	Willingness		Effectiveness		Practice	
	Owner	Manager	Owner	Manager	Owner	Manager
DP1: Strengthen windows with sheet covers or plywood	0.0202	0.091	-0.093	0.368	0.144	-0.159
held by wooden our metallic battens	(0.151)	(0.208)	(0.143)	(0.234)	(0.144)	(0.228)
Observations	771	318	771	318	771	318
R2	0.002	0.005	0.002	0.023	0.026	0.025
DP2: Strengthen doors with wooden or metallic	-0.085	-0.113	-0.247	0.214	0.067	-0.044
crossbars fixed to the wall	(0.144)	(0.216)	(0.141)	(0.233)	(0.140)	(0.218)
Number of firms	812	326	812	326	812	326
R2	0.002	0.001	0.005	0.005	0.036	0.051
DP3: Strengthen roof between beams	-0.072	0.171	-0.076	0.328	-0.004	0.282
with metallic strings or straps	(0.135)	(0.215)	(0.133)	(0.221)	(0.131)	(0.212)
Number of firms	907	353	907	353	907	353
R2	0.002	0.002	0.003	0.009	0.033	0.043
DP4: Strengthen roof with more nails	-0.046	0.154	-0.123	0.189	0.113	0.047
	(0.132)	(0.215)	(0.135)	(0.208)	(0.133)	(0.217)
Number of firms	921	352	921	352	921	352
R2	0.006	0.014	0.004	0.040	0.005	0.014
DP5: Elevate material	0.077	0.007	-0.078	0.204	0.068	0.144
	(0.124)	(0.202)	(0.125)	(0.203)	(0.126)	(0.202)
Number of firms	1048	388	1048	388	1048	388
R2	0.001	0.013	0.003	0.004	0.005	0.033
DP6: Plant trees	-0.064	-0.183	-0.065	0.043	0.006	0.009
	(0.123)	(0.215)	(0.122)	(0.215)	(0.125)	(0.207)
Number of firms	1048	388	1048	388	1048	388
R2	0.004	0.004	0.005	0.009	0.003	0.011
DP7: Protection wall	-0.216	-0.079	-0.294*	0.081	-0.142	0.327
	(0.123)	(0.209)	(0.124)	(0.204)	(0.125)	(0.209)
Number of firms	1048	388	1048	388	1048	388
R2	0.004	0.012	0.008	0.016	0.002	0.010
DP8: Use sand sacks	-0.232	0.126	-0.281*	0.263	-0.054	0.169
	(0.124)	(0.205)	(0.124)	(0.201)	(0.125)	(0.207)
Number of firms	1048	388	1048	388	1048	388
R2	0.006	0.002	0.007	0.010	0.003	0.014
DP9: In collaboration with neighbours	-0.071	-0.313	-0.0062	-0.275	0.032	0.071
clean neighbourhoods drainage canals	(0.126)	(0.196)	(0.123)	(0.202)	(0.125)	(0.208)
Number of firms	1048	388	1048	388	1048	388
R2	0.010	0.023	0.040	0.055	0.000	0.001
DP10: Change location	0.008	-0.114	-0.023	-0.095	0.168	0.175
	(0.126)	(0.201)	(0.124)	(0.210)	(0.127)	(0.196)
Number of firms	1048	388	1048	388	1048	388
R2	0.001	0.007	0.000	0.004	0.006	0.010
Pictures	-0.177	0.067	-0.229	0.182	0.007	0.054
index	(0.127)	(0.186)	(0.127)	(0.186)	(0.125)	(0.195)
Number of firms	1048	388	1048	388	1048	388
R2	0.017	0.005	0.018	0.003	0.007	0.051
No pictures	-0.150	-0.163	-0.211	0.060	0.015	0.271
index	(0.124)	(0.204)	(0.123)	(0.209)	(0.126)	(0.205)
Number of firms	1048	388	1048	388	1048	388
R2	0.003	0.009	0.012	0.023	0.001	0.020
Disaster preparedness	-0.211	-0.029	-0.281*	0.165	0.013	0.190
index	(0.127)	(0.190)	(0.126)	(0.193)	(0.125)	(0.200)
Number of firms	1048	388	1048	388	1048	388
R2	0.016	0.003	0.024	0.007	0.005	0.045

Note: Note: mean estimates including firm and time fixed effects. The sample of managers includes 15 observations that are employees such as HR-representatives or accountants instead of managers.
Source: authors' calculations based on MSMC data.

B1 Different specification

Table A17: Information and disaster preparedness—ATT

	Willingness	Effectiveness	Practice
Disaster preparedness measures from pictures			
DP1: Strengthen windows with sheet covers or plywood	0.102	0.093	0.003
held by wooden our metallic battens	(0.086)	(0.079)	(0.087)
Observations	1,089	1,089	1,089
R2	0.002	0.003	0.022
DP2: Strengthen doors with wooden or metallic	-0.030	-0.032	-0.009
crossbars fixed to the wall	(0.076)	(0.078)	(0.082)
Number of firms	1,138	1,138	1,138
R2	0.001	0.000	0.039
DP3: Strengthen roof between beams	-0.021	0.047	0.121
with metallic strings or straps	(0.078)	(0.071)	(0.076)
Number of firms	1,260	1,260	1,260
R2	0.001	0.001	0.031
DP4: Strengthen roof with more nails	0.054	0.037	0.048
	(0.081)	(0.078)	(0.078)
Number of firms	1,273	1,273	1,273
R2	0.007	0.008	0.006
DP5: Elevate material	0.063	0.040	-0.019
	(0.070)	(0.069)	(0.074)
Number of firms	1,436	1,436	1,436
R2	0.001	0.002	0.009
DP6: In collaboration with neighbours	-0.108	-0.151*	-0.021
clean neighbourhoods drainage canals	(0.081)	(0.079)	(0.076)
Number of firms	1,436	1,436	1,436
R2	0.011	0.041	0.000
Pictures	-0.029	-0.050	-0.001
index	(0.075)	(0.075)	(0.071)
Number of firms	1,436	1,436	1,436
R2	0.006	0.014	0.014
Disaster preparedness measures NOT shown in pictures			
DP7: Protection wall	-0.061	-0.053	0.023
	(0.075)	(0.073)	(0.075)
Number of firms	1,436	1,436	1,436
R2	0.002	0.004	0.000
DP6: Use sand sacks	-0.017	-0.038	0.010
	(0.075)	(0.073)	(0.075)
Number of firms	1,436	1,436	1,436
R2	0.000	0.002	0.005
DP9: Plant trees	-0.022	0.068	0.078
	(0.077)	(0.073)	(0.076)
Number of firms	1,436	1,436	1,436
R2	0.003	0.004	0.004
DP10: Change location	0.065	0.008	0.080
	(0.078)	(0.075)	(0.073)
Number of firms	1,436	1,436	1,436
R2	0.000	0.000	0.004
No pictures	-0.012	-0.002	0.055
index	(0.074)	(0.068)	(0.070)
Number of firms	1,436	1,436	1,436
R2	0.001	0.004	0.001
Disaster preparedness	-0.041	-0.041	0.031
index	(0.072)	(0.070)	(0.068)
Number of firms	1,436	1,436	1,436
R2	0.007	0.015	0.010

Note: Note: mean estimates.
Source: authors' calculations based on MSMC data.

C Socio-psychological characteristics and risk perception—Replication of van der Linden (2015)

We aim at replicating van der Linden's model (2015). The model examines the socio-psychological characteristics of individuals and their association with climate change risk perception. We obtain similar results as van der Linden. The more an individual (a firm owner) views extreme weather as unpleasant, unfavourable, and negative, the higher their risk perception. This 'affective impression' represents the biggest coefficient associated with risk perception in terms of magnitude for both individuals (van der Linden 2015) and entrepreneurs. However, there are several differences between the associations for individuals found by van der Linden (2015) and our work on enterprises. First, descriptive norms (i.e. the extent to which referent others are taking action to help reduce the risk of climate change) are associated with risk perception in van der Linden's model, but much more so in our study. One explanation for this might be that Mozambique is a collective culture such that descriptive norms are more relevant than in more individualistic cultures that van der Linden studies. Second, prescriptive norms (the extent to which an individual feels socially pressured to view climate change as a risk that requires action) and biospheric values (caring for non-human nature and the biosphere itself) are significantly correlated with risk perception in van der Linden´s model but are statistically insignificant in our study. Third, while several types of climate change knowledge are associated with risk perception in van der Linden´s model, in Mozambique we find that it is physical knowledge of climate change that is significantly correlated with risk perceptions.

Table A18: Risk perception and socio-psychological characteristics—Simple OLS, one survey round

	Climate change	Cyclones	Floods
Firm characteristics			
Entrepreneurial	0.157***	0.127***	0.185***
orientation	(0.045)	(0.041)	(0.051)
Disaster			
Cyclone experience	0.092***	0.121***	0.112***
	(0.022)	(0.020)	(0.022)
Floods experience	0.048**	0.085***	0.090***
	(0.022)	(0.020)	(0.023)
Climate change knowledge			
Causes of CC	-0.036	0.033	-0.022
	(0.035)	(0.033)	(0.039)
Consequences of CC	0.023	0.032	0.018
	(0.032)	(0.030)	(0.037)
Physics of CC	0.134***	0.118***	0.101**
	(0.034)	(0.032)	(0.040)
Values			
Affect	0.596***	0.407***	0.525***
	(0.042)	(0.038)	(0.046)
Descriptive	0.232***	0.125***	0.161***
	(0.037)	(0.033)	(0.038)
Prescriptive	0.016	0.036	0.010*
	(0.029)	(0.025)	(0.030)
Biospheric	0.001	0.030	0.032
	(0.046)	(0.043)	(0.054)
Altruistic	-0.090**	-0.124***	-0.108**
	(0.045)	(0.041)	(0.045)
Egoistic	0.007	-0.006	-0.019
	(0.031)	(0.028)	(0.032)
Number of firms	718	718	718
R2	0.55	0.47	0.46

Note: Note: mean estimates.
Source: authors' calculations based on MSMC data.

We investigate if providing enterprises with information about disaster preparedness measures impacted their risk perception. Information provision did not significantly affect enterprises' risk perceptions.

Table A19: Risk perception and socio-psychological characteristics—FE

	Climate change		Cyclones		Floods	
Firm characteristics						
Treatment		-0.066		-0.033		-0.117
		(0.080)		(0.069)		(0.088)
Entrepreneurial	0.060*	0.061*	0.058**	0.059**	0.103***	0.104***
orientation	(0.033)	(0.033)	(0.028)	(0.028)	(0.036)	(0.036)
Disaster experience						
Cyclone experience	0.099***	0.098***	0.091***	0.090***	0.084**	0.081**
	(0.030)	(0.030)	(0.026)	(0.026)	(0.034)	(0.034)
Floods experience	0.046**	0.047**	0.049**	0.050**	0.065**	0.067***
	(0.022)	(0.022)	(0.020)	(0.020)	(0.025)	(0.025)
Climate change knowledge						
Causes	0.048	0.049	0.092***	0.093***	0.077**	0.079**
	(0.033)	(0.033)	(0.029)	(0.028)	(0.038)	(0.038)
Consequences	-0.019	-0.018	-0.009***	-0.008	-0.043	-0.040
	(0.031)	(0.031)	(0.029)	(0.029)	(0.036)	(0.036)
Physics	0.064*	0.064*	0.084***	0.084***	0.052	0.052
	(0.035)	(0.035)	(0.032)	(0.032)	(0.038)	(0.038)
Values						
Affect	0.521***	0.522***	0.349***	0.350***	0.383***	0.385***
	(0.031)	(0.031)	(0.027)	(0.026)	«(0.034)	(0.034)
Descriptive	0.163***	0.162***	0.101***	0.101***	0.209***	0.207***
	(0.031)	(0.031)	(0.028)	(0.028)	(0.033)	(0.032)
Prescriptive	0.029	0.029	0.016	0.016	0.016	0.016
	(0.029)	(0.029)	(0.025)	(0.025)	(0.033)	(0.032)
Biospheric	-0.020	-0.019	0.028	0.029	-0.009	-0.006
	(0.039)	(0.039)	(0.035)	(0.035)	(0.045)	(0.046)
Altruistic	-0.017	-0.017	-0.018	-0.018	-0.033	-0.032
	(0.036)	(0.036)	(0.031)	(0.031)	(0.039)	(0.039)
Egoistic	0.057*	0.057*	0.027	-0.027	0.029	0.028
	(0.033)	(0.033)	(0.026)	(0.026)	(0.036)	(0.036)
Number of firms	718	718	718	718	718	718
R2	0.38	0.38	0.31	0.31	0.29	0.29

Note: Note: mean estimates.
Source: authors' calculations based on MSMC data.