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Self-stated recovery from flooding: Empirical results from a survey in Central Vietnam

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Abstract

Social inequalities lead to flood resilience inequalities across social groups, a topic that requires improved documentation and understanding. The objective of this paper is to attend to these differences by investigating self-stated flood recovery across genders in Vietnam as a conceptual replication of earlier results from Germany. This study employs a regression-based analysis of 1,010 respondents divided between a rural coastal and an urban community in Thua Thien-Hue province. The results highlight an important set of recovery process-related variables. The set of relevant variables is similar across genders in terms of inclusion and influence, and includes age, social capital, internal and external support after a flood, perceived severity of previous flood impacts, and the perception of stress-resilience. However, women were affected more heavily by flooding in terms of longer recovery times, which should be accounted for in risk management. Overall, the studied variables perform similarly in Vietnam and Germany. This study, therefore, conceptually replicates previous results suggesting that women display slightly slower recovery levels as well as that psychological variables influence recovery rates more than adverse flood impacts. This provides an indication of the results' potentially robust nature due to the different socio-environmental contexts in Germany and Vietnam.

KEYWORDS

flood recovery, resilience, societal equity, vulnerability

1 | INTRODUCTION

Flooding has a large impact on humanity resulting in concerted flood risk management efforts. While the main objective in flood risk management is to prevent or reduce flood impacts on society, a speedy and full recovery process after being impacted is equally important for personal and societal well-being and prosperity as highlighted through the concept of resilience (Weichselgartner & Kelman, 2015). To deal with financial impacts, risk transfer mechanisms have been put in place in many countries and have been investigated in detail (Atreya, Hanger, Kunreuther, Linnerooth-Bayer, & Michel-Kerjan, 2015; Hanger et al., 2018; Hudson,

Thieken, & Bubeck, 2019, Hudson, Botzen, & Aerts, 2019, Hudson, Pham, & Bubeck, 2019; McAneney, McAneney, Musulin, Walker, & Crompton, 2016; Seifert-Dähnn, 2018). Besides risk transfer mechanisms, the literature on recovery mostly focuses on the physical reconstruction and/or replacement of damaged property (Kates, Colten, Laska, & Leatherman, 2006; Kienzler, Pech, Kreibich, Müller, & Thieken, 2015; Thieken, Kreibich, Mükker, & Lamond, 2017), or economic recovery, for example, Klomp (2016). A related body of literature examines health following floods, indicating long-lasting impacts (Thieken et al., 2016; Zhong et al., 2018). However, full recovery also includes people's subjective perception of recovery and well-being, as a measurement of their welfare, but the literature exploring the variables related to self-stated or subjective flood recovery is limited (Bubeck & Thieken, 2018). Therefore, it still remains unclear to what extent self-stated flood recovery is dependent on adverse flood impacts (e.g., the range of impacts suffered), the circumstances of the recovery process itself (e.g., social assistance), socio-economic characteristics (e.g., education), and psychological factors (e.g., risk aversion). Furthermore, the role of these variables can also differ across social groups due to social inequalities and interactions, for example, Cutter (2017), or how people subjectively position themselves within society based on gender stereotypes (Hebert et al., 1997; Sigmon et al., 2005) and how different respondents consider the subjective recovery process differently. These multi-faceted interactions create a complex situation to studying self-stated flood recovery. This complex concept requires additional research and replication to provide a deeper initial understanding of what drives self-stated flood recovery and can contribute to future studies and flood management practices.

Moreover, as self-stated recovery is a complex concept, the first step in achieving a better understanding of the accuracy and reliability of recovery statements of flood-affected people is to conceptually replicate the questions developed in one context in another context. This is because conceptual replication allows for the consistency of results to be judged as an initial first step. Furthermore, the existing literature regarding self-stated flood recovery mainly focuses on industrialised countries (Cutter, 2017). Whether the findings of previous studies can be replicated in developing countries is, therefore, unclear. This is problematic, as developing countries are severely impacted by floods, particularly in Asia, where nearly two-thirds of the global flood losses and victims between 1980 and 2005 occurred (CRED-UNISDR, 2015). Moreover, developing countries are expected to suffer disproportionately from climate change and environmental degradation (Mirza, 2003). It is, therefore, surprising that the self-stated flood recovery process has not been actively investigated in developing countries, especially in view of the amount of resources spent on humanitarian action for immediate relief after a flood, which should be guided towards their most productive uses (Kellett & Caravani, 2013).

We address this research gap by exploring self-stated flood recovery in a developing country context (Vietnam). Moreover, we investigate whether the overall findings are consistent with those from a developed country (Germany) through a conceptual replication of an existing study (Bubeck & Thieken, 2018). Consistency in results across such different socio-economic and cultural contexts such as Vietnam and Germany would indicate that findings can indeed be generalised across geographies. While Germany ranks fourth in the Human Development Index with a gross national income (GNI) per capita of nearly 47,000 USD, Vietnam ranks 118 with a GNI per capita of 6,220 USD (UNDP, 2019). While Germany is a parliamentary democracy, Vietnam is a communist state that liberalised its economy in the late 1980s and since then experienced rapid economic growth. A further difference is that in comparison, patriarchy has had a relatively stronger influence in Vietnam as compared to Germany (Do & Brennan, 2015; Lam & Laura, 2017). This has led to a deepening of gender based inequalities as, for example, the Global Economic Forum's Global Gender Gap Index 2020 report ranks Germany 10th and Vietnam 86th in the world in terms of the smallest gender gap (World Economic Forum, 2020).

We explore the self-stated flood recovery of individuals in Thua Thien-Hue province in Vietnam through survey data. The indicator for self-stated flood recovery is based on Bubeck and Thieken's (2018) study in Germany to ensure conceptual comparability, in addition to their overall methodological approach on German survey respondents who have returned to their pre-flood state after a major flood. Bubeck and Thieken (2018) find that hydraulic characteristics of the flood processes proved to be a relatively unimportant domain compared to the explanatory potential of the psychological domain (Bubeck & Thieken, 2018). In addition, they find that women tend to report a lower level of self-stated flood recovery and indicate that further investigation is needed. Bubeck and Thieken (2018) argue that not accounting for different recovery trajectories in flood responses limits societal resilience. This need also corresponds to global policy frameworks that are increasingly focusing on gender issues, for example, goal 5 of the Sustainable Development Goals (UN, 2019) and the Sendai Framework for Disaster Risk Reduction 2015–2030 (UNISDR, 2015).

We focus on gender differences in this study to provide an indication of how robust the findings on

self-stated flood recovery are and to what extent they can be generalised, or transferred, to another geographical and socio-cultural context. A conceptual replication of previous work is of interest given the growing call for the replication of empirical studies, for example, Mueller-Lander, Fecher, Harhoff, and Wagner (2019). In addition, to the best of our knowledge, the current study is the second to empirically explore self-stated flood recovery, and the first to do so in Vietnam in a developing country context.

2 | DATA AND METHODS

2.1 | Study sites

The study location is Thua Thien-Hue province in central Vietnam (Figure 1). The province has over 1 million residents (General Statistics Office of Vietnam, 2016) and suffers from coastal, fluvial, and pluvial flooding. Key hydrological features of the province are the Huong River and the Tam Giang Lagoon, on which over 300,000 residents rely for their livelihood (Tuyen, Armitage, & Marschke, 2010). The most recent significant flood event in the province was in November 2017 (Typhoon Damrey). This typhoon led to US$37 million in monetary losses and nine deaths in the province. The worst flood in recent history occurred in 1999, with 547 deaths and monetary losses of US$200 million (Valeriano et al., 2009).

In response to the chronic flooding in Thua Thien Hue, several ecosystem-led measures were implemented. Within the citadel area of Hue City, urban water bodies are a part of the traditional flood management system. However, over time their drainage capacity was reduced through a range of reasons. The activities within Hue city aimed to restore these bodies to increase their drainage capacity. In the coastal area, a new mangrove forest was planted by the Department of Forestry in the Quang Loi

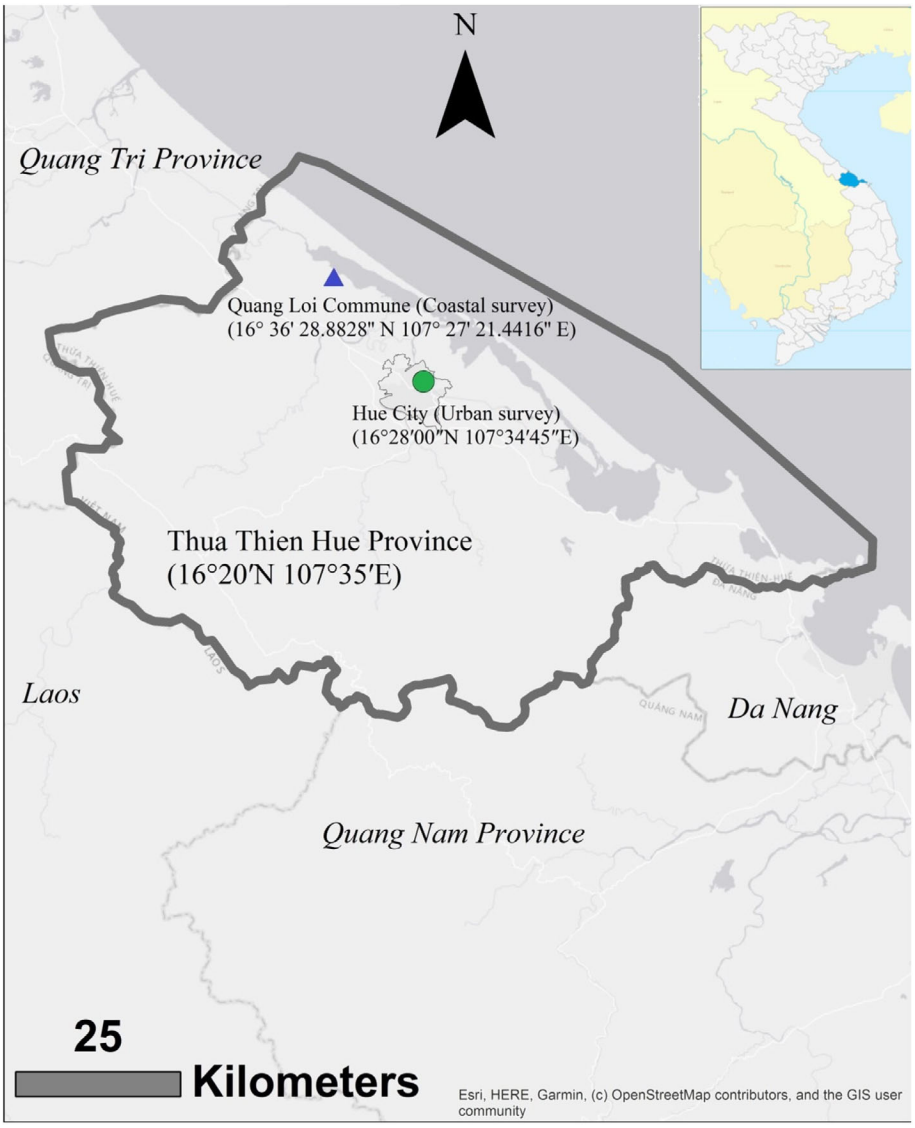

FIGURE 1 A map of the survey sites within Thua Thien Hue Province in central Vietnam (main figure) and the location of the provience within Vietnam (the blue area in the thumbnail). The survey consists of 505 respondents from Hue City as an urban study area and 505 respondents from Quang Loi Commune as a coastal survey area, adapted from Hudson, Hagedoorn, and Bubeck (2020)

commune. Mangroves were planted as they provide multiple benefits to the local residents through the ecosystem services provided (DKKV, 2019). For example, the mangroves act as a natural flood defence against relatively frequent flood or storm events, while improving water quality and biodiversity.

These areas were selected for two reasons: one of the survey's wider objectives was to evaluate the ecosystem benefits from these measures, as in DKKV (2019) or Hagedoorn, Koetse, van Beukering, and Brander (2020), which requires tangible experience with these ecosystem-led measures. Second, urban and coastal areas are the current and future hotspots of flood impacts (Birkmann, Welle, Solecki, Lwasa, & Garschagen, 2016). However, while these objectives were important for the project, they do not interact with the specific objectives of the current paper.

2.2 | Data collection

Three data collection waves were conducted. For the first wave, the pre-test survey, 50+ respondents were surveyed face-to-face. In the second wave, the pilot survey, 160 respondents were surveyed, evenly split across the study areas. In the third wave, 1,010 respondents evenly divided over the study areas were surveyed. Respondents could only take part in one survey wave, and one person per household was surveyed.

The survey was conducted between June and September 2017. The respondents were surveyed face-to-face in their homes using Kobo Toolbox. A team of 14 local enumerators was trained over a period of 4 days. The target interviewee was the household head or their partner, allowing for differentiation according to the gender of the respondent. Respondents were sampled randomly from each village (coastal area) or ward (urban area) in accordance with their relative size, based on information provided by local community leaders. Each question asked the respondent to consider the answer in relation to themselves or to the entire household as appropriate. Hudson, Botzen, and Aerts, (2019), Hudson, Pham, and Bubeck, (2019), and Hudson, Thieken, and Bubeck, (2019) note that the sample is representative of the province, with the potential caveat to this approach is that when households took part in the survey the respondent was in effect chosen by the households, in turn determining whether the respondent was male or female.

2.3 | Survey objectives

The goal of the first wave, the pre-test survey, was to gain an initial understanding of the local situation. The goal of the second wave, the pilot survey, was to test and adjust the survey questions before they were deployed in the third wave for the main data collection effort. The third-wave questionnaire consisted of eight sections: dependence on ecosystem services, environmental perceptions, subjective well-being or happiness, risk perceptions, discrete choice experiment and debriefing, community life, flood experiences, and demographics. The survey was embedded in the scientific literature using questions described in previous studies (Botzen, Kunreuther, & Michel-Kerjan, 2015; Bubeck & Thieken, 2018; Hagedoorn et al., 2019; Onyx & Bullen, 2000; Poussin, Botzen, & Aerts, 2013). These questions were adapted to the local context based on the results of the pre-test and pilot surveys. The questionnaire is identical across study sites except for the site-specific ecosystem-led measures. The questionnaire was originally developed in English and translated into Vietnamese.

2.4 | Operationalisation

Our objective is to conduct a conceptual replication of Bubeck and Thieken (2018) using only the data collected in the third survey wave. This is a conceptual replication because surveys must be adapted to local circumstances for successful data collection. Therefore, a study from Germany cannot be directly and exactly replicated in Vietnam. The questions asked in the original German survey must be translated into Vietnamese and the entire survey must be adapted for clarity and suitability in the new context. This implies possible changes in question nuances, which can slightly change the understanding of the questions and core concepts (for example, see the discussion presented in Berkowitz, 2013 regarding the resilience concept). This process is a necessary part of successful empirical work but can cause divergence between the studies to be replicated. Therefore, the variables used in Bubeck and Thieken (2018) act as a base for the questions asked to Vietnamese respondents. For example, self-stated recovery is measured on a scale from 0 (no recovery) to 10 (complete recovery) in terms of the following: *To what extent do your previous flood experiences still affect you today*? This is slightly different from the question asked in Bubeck and Thieken (2018), which was: *To what extent does the flood event of May/June 2013 still affect you today*? as measured on a six-point scale. These changes occurred because the Vietnamese pre-deployment testing indicated that the survey would be more successful if all Likert scales were harmonised to a common 11-point scale. In addition, the focus of the question was also changed. Bubeck and Thieken (2018) deployed a survey directly after a specific, relatively rare flood event, while flooding is endemic in the Vietnamese

study area. Therefore, it was deemed more suitable to focus on flood experiences in a more general manner. In both studies no additional information was provided to the respondents regarding flood recovery, allowing the focus to remain on how strongly they believe themselves to be impacted by their history of flooding.

However, as noted in the introduction, it must be remembered that empirically studying self-stated flood recovery is a complex issue. For instance, one of the complexities of studying self-stated flood recovery is that the lower recovery status of women compared to men from flooding could be caused (in part) by respondents answering in line with societal norms (Hebert et al., 1997) indicating a perceived gender difference in how recovery is perceived. This consideration is relevant, since recovering from flood experiences could be seen to reflect perceived strength of character or other typically masculine stereotypes, which may lead men to overstate their level of recovery (Sigmon et al., 2005). A second complexity concerns the additional nuance of what self-stated flood recovery means to an individual respondent that even if they were provided with the same scale and description, they were considering different concepts due to their socio-normative positioning, e. age, previous flood experiences. This potentially leads to the concept of "flood recovery" to be interpreted differently by the respondents. While these complexities are valid, this study sought to complete a conceptual replication, and extension, of the exploratory analysis conducted by Bubeck and Thieken (2018) in Germany. Regarding the complexities, the approach undertaken here sidesteps this issue by attempting to detect, which correlations and differences could be most important in the underlying data rather than establishing direct causal relationships to predict responses.

To conduct the analysis, 36 variables are used to explore self-stated flood recovery based on those used in a survey (Table 1) in the study to be replicated (Bubeck & Thieken, 2018). Similarly, the studied variables are grouped into four overall domains that can potentially affect self-stated flood recovery based upon expert judgement. The four domains are as follows: the flood impacts domain, the recovery process domain, the socio-economic domain, and the psychological domain. The items belonging to each domain can be seen in Table 1.

Flood impacts capture the level of severity from which the recovery process starts (Bubeck & Thieken, 2018). Following the initial shock based on the severity of a flood, circumstances of the recovery process such as support received from outside or from within the community can influence the individual recovery process, as indicated by the literature on mental health outcomes of disasters (Bonanno, Brewin, Kaniasty, & Greca, 2010). The socio-economic domain, including variables such as gender or age, may also result in different recovery outcomes (Bubeck & Thieken, 2018). Finally, variables from within the psychological domain, such as subjective risk perceptions and mental pre-occupation, can influence the way individuals respond to and recover from external shocks (Norris, Friedman, & Watson, 2002).

2.5 | Data analysis

The method for exploring the relation between the four domains and self-stated flood recovery are regression models. We employ a stepwise process of variable selection adapted from Bubeck and Thieken (2018). The core principle behind an iterative stepwise process in general is that the set of variables included in the model is refined by systematically removing the variable(s) with the highest *p*-value, until only variables deemed to be statistically significant remain. Iterative backwards-stepwise processes (Fields, 2009) have been used in a range of studies within risk research (Botzen, Kunreuther, Czajkowski, & de Moel, 2019; Bubeck, Botzen, Kreibich, & Aerts, 2013; Bubeck & Thieken, 2018; Ganguly, Nahar, & Hossain, 2019; Kabra, Ramesh, & Arshinder, 2015; Roder, Hudson, & Tarolli, 2019; Sarmiento, Sandoval, & Jerath, 2020).

A split and full sample approach is employed, which is where a model that includes all respondents (the full sample) is estimated, as in Bubeck and Thieken (2018), but the approach is also repeated for samples consisting of only male or female respondents. This approach can allow for a deeper understanding across genders. Figure 2 shows that the analysis is conducted in three iterative steps. First, separate regressions between a respondent's self-stated flood recovery and the variables within one of the domains are estimated for both genders and the combined sample. These regressions are predominately ordered probit regressions because the dependent variable is ordinal, that is, 11-point scales. Linear models are also estimated for adjusted R^2 values. Heteroscedasticity is accounted for by using heteroscedasticity-corrected standard errors. The statistically significant variables (threshold is the 10% level) in each model estimated through the split sample approach are recorded. In the second step, these recorded variables are then combined into a larger overall model to which a stepwise process is applied, in which the variable with the highest p-value is removed and the model re-estimated. This process is repeated until only statistically significant variables (threshold is the 10% level) remain. The third step is to merge the statistically significant variables across samples to generate the final model (with the addition of the *female* dummy variable) for the full sample of respondents. When estimated, the

TABLE 1 Set of possible variables that influence a respondent's self-stated flood recovery

Variable classification	Variables included	Variable definition
Dependent variable	Self-stated flood recovery status	A scale from 0 (no recovery) to 10 (complete recovery) as the response to the following question: To what extent do your previous flood experiences still affect you today?
Respondent's flood impacts	Experienced 1999 flood	The respondent's worst flood experience was the 1999 flood. This flood was selected as it is the largest flood in recent history
	Time since the last flood	The number of years elapsed since the last flood the respondent experienced
	Flood impact index	An index between [0,1] corresponding to number of potential impacts suffered (i.e., damage to property, injury, etc.)
	Repairs	The average number of repairs to the respondent's property over the last 10 years
The recovery process	Social capital	An index of the respondent's level of social capital (scale 0–10). This variable captures the degree to which the respondent believes his/her community is united as measured via the concept of bonding capital (i.e., within-community ties). This is measured by taking the average response across eight questions based on those initially presented in Onyx and Bullen (2000)
	Access to internal community help to recover from a flood	A value between 0 and 10 indicting the degree to which the respondent felt he/she had access to community help, or their own savings, to recover from flooding
	Access to external community help to recover from a flood	A value between 0 and 10 indicting the degree to which the respondent felt they had access to NGO/charities/government help to recover from flooding
	Number of tasks after flood	The number of tasks the respondent is responsible for completing in the aftermath of a flood
Respondent's socio-economic status and conditions	Female	A dummy variable indicating whether the respondent is woman (1) or not (0)
	Coastal	A dummy variable indicating whether the respondent lives in the coastal (1) or urban (0) community
	Age	The respondent's age
	Household size	The number of individuals in the respondent's household
	Dependency ratio	The percentage of individuals in the respondent's household who are younger than 14 or older than 65
	Primary school	The respondent's highest level of completed education is primary school
	Secondary school	The respondent's highest level of completed education is secondary school
	High school	The respondent's highest level of completed education is high school
	Technical school	The respondent's highest level of completed education is technical college
	University	The respondent's highest level of completed education is a university degree
	High income	The respondent has an annual income of at least 8 million VND
	Self-assessed health status	The respondent's self-assessed score on a scale of 0 to 10 regarding satisfaction with his/her health status
	Permanent housing	The respondent's housing is permanent rather than temporary
	Own building	The respondent owns his/her home rather than renting

TABLE 1 (Continued)

Variable classification	Variables included	Variable definition
Psychological variables	Perceived likelihood of being flooded in the average year	The respondent believes that he/she is likely to be affected by a flood in the average year
	Flood worry	The respondent worries about the potential impacts and consequences of a flood
	Bad flood impacts	The respondent believes that if the household is flooded the impacts will be large
	Flooding is getting worse	The respondent believes that flooding will become worse in the future
	Not stress resistant	The respondent's self-stated agreement with the statement on a scale of 0–10
	Risk averse	The respondent's self-stated agreement with the statement on a scale of 0–10
	Perceived severity of previous flood impacts	The respondent's self-stated agreement with the statement on a scale of 0–10, where 0 is not severe and 10 very severe.
	Average level of trust	The respondent's self-stated level of trust (0–10) across their community, friends and family, charity/NGO, private businesses
	Mental pre-occupation	How often the respondent thinks about previous flood experiences
	Nothing can be done to stop or limit the impacts of flooding	The respondent's self-stated agreement with the statement on a scale of 0–10
	The community as a whole faces serious problems from storms and flooding	The respondent's self-stated agreement with the statement on a scale of 0–10

value can be understood as the difference between males and females on the group average level of self-stated recovery (Wooldridge, 2012). This is because the respondents in the '0' category are the basis of comparison of averages. Reversing categories would only reverse the direction of the estimated coefficient, but not influence the effect size.

3 | RESULTS AND DISCUSSION

3.1 | Results

The results of the regression models, analysing the relations between the four domains on self-stated flood recovery, in terms of R^2 are presented in Table 2. The domain with the lowest R^2 values is flood impacts, with a similar performance for the socio-economic domain (pseudo $R^2 = \sim 2\%$, adjusted $R^2 = \sim 3$–6%). The recovery process domain has a higher explanatory power (pseudo $R^2 = \sim 12\%$, adjusted $R^2 = \sim 34\%$). The highest explanatory power is identified for the psychological domain (pseudo $R^2 = \sim 15\%$, adjusted $R^2 = \sim 39\%$). This order of importance of the four domains is different from the one presented in Bubeck and Thieken (2018), where the domains are ranked as follows: flood impacts ($R^2 = 0.09$), recovery process ($R^2 = 0.13$), socio-economics ($R^2 = 0.21$), and psychological ($R^2 = 0.35$). Although the recovery process and socio-economic domains are switched in this order across our study sites and those in Germany, the first and last domains are the same. Across both genders, we find that the flood impacts and socio-economic domains are roughly equally important. The psychological and recovery process domains, however, appear to explain more of the variation in recovery status for the female than for the male respondents. Moreover, the results presented in Table 2 indicate that the studied domains and variables also explain more of the overall variation in self-stated flood recovery for women as compared to men.

Table 3 displays the results of the final ordered probit regression models using only the significant variables after the stepwise process of variable selection (Figure 2). In comparing the models, we can gain an understanding of how the recovery process may differ between men (M1) and women (M2), or a direct comparison of the average level of self-stated flood recovery across genders due to the "*female*," included in M3. In addition, M3 is the most directly comparable model to Bubeck and Thieken (2018), as M3 includes all eligible survey respondents. We first focus on the comparison of M1 and M2, where we find that there is a substantial overlap between the variables that are found to be statistically significant across genders.

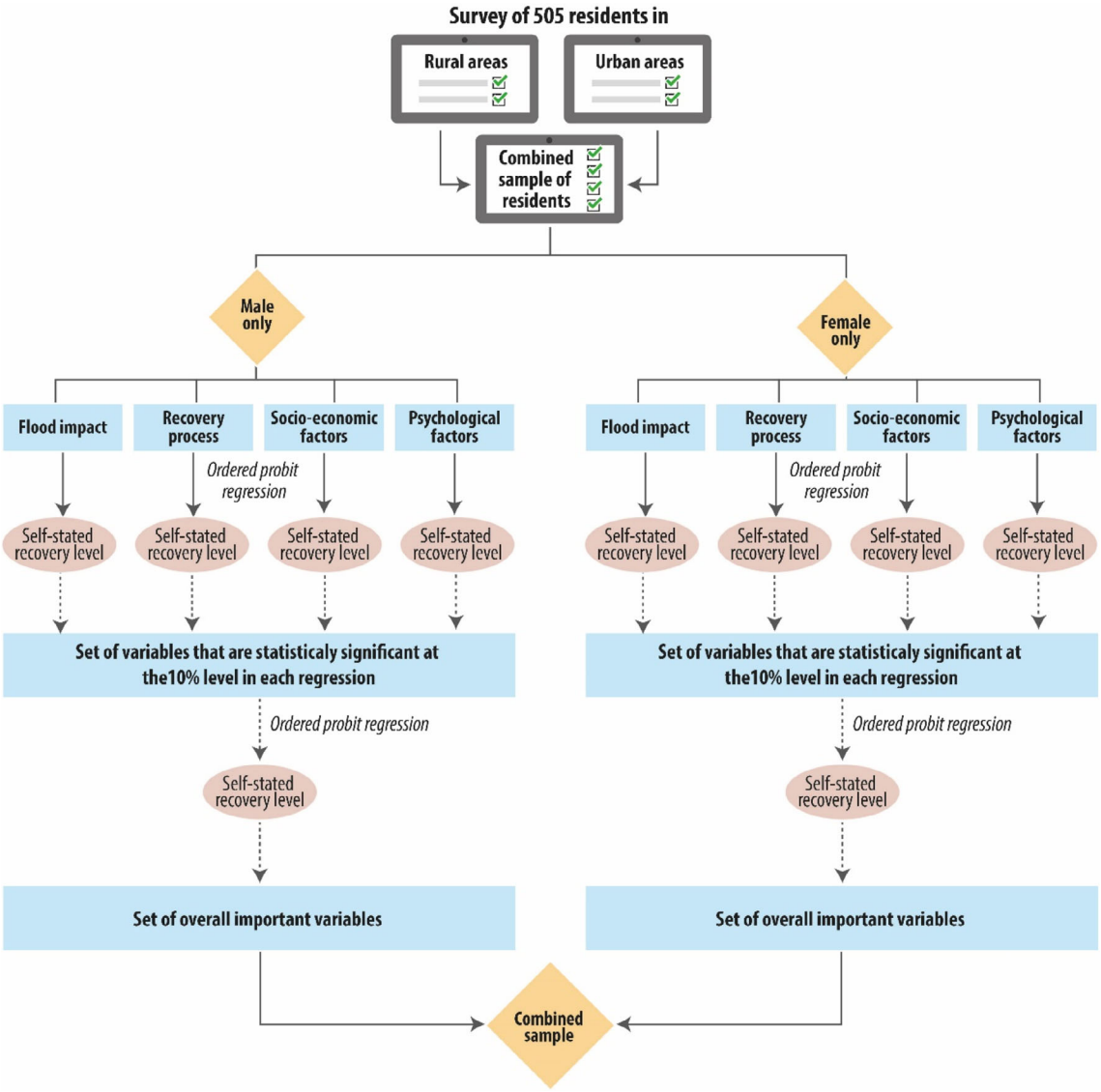

FIGURE 2 A flow chart of the exploratory variable selection approach. Blue boxes indicate key recovery domains; Red ovals represent dependent variables. Yellow diamonds indicate the set of observations included in the ordered probit regressions using the overall set of variables with self-stated flood recovery as the dependent variable; solid lines represent the use of all relevant variables; dashed lines indicate only variables at the 10% significance level

This means that 60% of the variables included are the same in M1 and M2: age, level of bonding social capital, access to internal and external support after a flood, perceived severity of previous flood impacts, and the perception of not being stress-resilient.

Exploring the results across M1 and M2, we focus on the statistical significance of the coefficients as well as the direction of the coefficients (positive or negative). This is because the ordered probit model is a non-linear model and, as such, the variables do not display a constant impact in terms of its magnitude on the outcome. However, the coefficients can be discussed in terms of their underlying role in the latent process (i.e., whether it is positive or negative). For the most part, the same variables are included in the male (M1) and female models (M2). The differences across M1 and M2 are found in the results for the following variables: "*number of repairs*" (female only, negative), "*risk averse*" (female only, negative), "*time since the last flood*" (male only, positive), and "*experienced the 1999 flood*" (male only, positive). Moreover, while "*perceived severity of previous flood impacts*" and "*not stress resistant*" are included in both models, their coefficients appear to be different. However, the coefficient estimates for '*not stress resistant*' in M1 and M2 overlap in terms of 95% confidence intervals (i.e., the estimated coefficient +/− 1.96*[coefficient's standard error]), indicating that they might not be as different as at first glance. This is because the more different the estimated coefficients are, the less the confidence intervals should overlap. For the variable "*perceived severity of*

TABLE 2 The R^2 values from the various regressions of each recovery domain group of variables for self-stated flood recovery

	Male observations	Female observations	All observations
Ordered Probit models pseudo R^2			
Flood impact domain	0.02	0.02	0.01
The recovery process domain	0.09	0.15	0.12
Socio-economic domain	0.01	0.02	0.02
Psychological domain	0.11	0.19	0.14
Final set of domain	0.17	0.24	0.2
Linear regression (adjusted) R^2			
Flood impact domain	0.07	0.06	0.05
The recovery process domain	0.26	0.42	0.33
Socio-economic domain	0.02	0.04	0.04
Psychological domain	0.31	0.48	0.39
Final set of domain	0.48	0.47	0.49
The order of importance for the recovery domains			
First	Psychological domain	Psychological domain	Psychological domain
Second	Recovery process domain	Recovery process domain	Recovery process domain
Third	Socio-economic domain	Flood impact domain	Flood impact domain
Fourth	Flood impact domain	Socio-economic domain	Socio-economic domain

Note: Regressions of the variables included in the separate recovery domains, run independently of each other.

TABLE 3 Overall ordered probit regression results for the relation between the identified variables and self-stated flood recovery

	Male observations (M1)	Female observations (M2)	All observations (M3)
Age	−0.02*** (0.004)	−0.02 (0.004)	−0.02*** (0.003)
Repairs		−0.03*** (0.01)	−0.03*** (0.01)
Bonding social capital	−0.19*** (0.05)	−0.22*** (0.05)	−0.2*** (0.04)
Access to internal community help to recover from a flood	−0.24*** (0.04)	−0.26*** (0.05)	−0.25*** (0.03)
Access to external community help to recover from a flood	0.15*** (0.02)	0.12*** (0.02)	0.014*** (0.02)
Perceived severity of previous flood impacts	−0.27*** (0.04)	−0.36*** (0.05)	−0.31*** (0.03)
Not stress resistant	−0.45*** (0.11)	−0.25** (0.12)	−0.38*** (0.08)
Risk averse		−0.46*** (0.12)	−0.24*** (0.09)
Time since the last flood	0.03*** (0.01)		0.01 (0.01)
Experienced 1999 flood	−0.47*** (0.16)		−0.21* (0.12)
Female			−0.12* (0.07)
N	488	427	859
R^2	0.17	0.24	0.2

Note: Values in parenthesis are heteroscedasticity-robust standard errors.
*Statistical significance at the 10% level.
**Statistical significance at the 5% level.
***Statistical significance at the 1% level.

previous flood impacts" in M1 and M2, the 95% confidence intervals overlap slightly. When taken together, these results indicate that the recovery process may be quite similar across genders. This is because 60% of the variables included in M1 and M2 are the same after the stepwise variable selection process. Moreover, even when

the parameter estimates appear quite different for a variable, this difference is less once the uncertainty in parameter estimates is considered.

The results of the model where we combined female and male respondents (M3) are also presented in Table 3. In the results for this model, we find that the "*female (dummy)*" variable is statistically significant and negative. This result indicates that women reported an overall lower level of recovery. This result may mean that women need more time to recover from floods. We investigate this by looking at the variable "*the time since the last flood*" in M1 and M2, which highlights the temporal dimension of flood recovery. We find that the longer ago the flood occurred, the more male respondents have recovered. This relation is not found in the female sample, which suggests that women recover at a slower pace. This is further confirmed when we consider that in M3 the variable "*the time since the last flood*" is no longer statistically significant. This is further checked by including an additional variable based on the interaction term between '*the time since the last flood*' and '*female*' variables (i.e., the product of these variables). Once this interaction term is included in model M3, the impact of '*the time since the last flood*' on self-stated flood recovery is again positive for men ($p < .01$), but the total effect for women is statistically insignificant ($p > .16$). A possible reason for the slower recovery of women is that in the aftermath of a flood women often face a high burden due to their social roles of caring for family members and recovering livelihood activities (Pham & Lam, 2016). These findings are in line with Bubeck and Thieken (2018).

In addition, across all models the variables related to support from within the community (i.e., savings and community help) are consistently negatively related to self-stated flood recovery, while external support (i.e., NGO or government help) is positively related to recovery. The first appears counterintuitive; however, support from within communities consists of short-term support in the immediate aftermath of the event (DKKV, 2019; Pham & Lam, 2016). This was confirmed via focus group discussions held with local community members, where a qualitative discussion of their experiences was conducted; see DKKV (2019) for details on these focus group discussions. The focus group discussions revealed that because the capacity to provide help from within the community is limited, it is provided especially to community members who are severely affected by the flood event, explaining the lower recovery status. The focus group discussions also revealed how external help is instead often more long-term and focused on restoring livelihoods, for example, through loans, financial relief, or training on agricultural production. The same reasoning holds for the marginal negative influence of the social capital variable, which contrasts with Bubeck and Thieken (2018), who found that social assistance was not an important variable in explaining self-stated flood recovery in Germany. This difference across the studies is likely a result of the different support systems in both countries. For instance, in Germany flood insurance coverage is estimated at 41% for residential buildings (German Insurance Association, 2018), while it is negligible in Vietnam (Reynaud, Nguyen, & Aubert, 2018), implying a greater reliance on support from their community social networks.

3.2 | Implications

3.2.1 | Implications for current research

The objective of this paper was to conduct a conceptual replication of Bubeck and Thieken (2018), but in a different socio-economic and environmental context. We find, despite the different contexts, similar core results: The inequalities that women face tend to result in a slower rate of self-stated recovery. This may be due, in part, to the absence of the variable "*the time since the last flood*" as a statistically significant predictor when female respondents were included in the sample (see M2 and M3 in Table 3). Moreover, we additionally find that the way in which the studied domains explain variation in self-stated flood recovery also differs across genders, as can be seen through the different R^2 values presented in Tables 2 and 3. These results indicate that not only might women feel the effects of their flood experiences longer than men, but the process through which recovery occurs is also subtly different. This difference is likely the result of socially constructed norms, as the psychological domain was the most important predictor.

Furthermore, the different contexts in which the studies were conducted allow the results to be transferable. This is because in both Bubeck and Thieken (2018) and the current study we judge the cross-cultural transferability based on how both surveys were carried out within particular cultural and socio-economic settings in which women have a specific role in families and wider society. These contextual placements are different from each other. Therefore, the similarity of the results within their different contexts, despite these differences, is an indicator of this potential robustness, transferability, and generalizability.

3.2.2 | Directions for future research

The similarity of our results Bubeck and Thieken (2018) in very different contexts is an indicator of the potential robustness, transferability, and overall generalizability of the finding that women tend to be more heavily impacted,

and that in terms of self-stated recovery psychological factors are likely the most important in determining the rate of recovery. However, there remain complexities and caveats that must be addressed with future research when studying self-stated flood recovery. The results of this study have several implications for the direction of future research on self-stated flood recovery. The first relates to the point highlighted above. Both we and Bubeck and Thieken (2018) focused upon factors at the level of a specific individual (and/or household) as relevant for the particular question. Therefore, how the household or individual is positioned in society is excluded from the analysis. However, a large body of research indicates that social capital, social norms, or social positioning can be linked with proactive community-level (Hagedoorn et al., 2019; Lo, Xu, Chan, & Su, 2015; Wolf, Adger, Lorenzoni, Abrahamson, & Raine, 2010) and individual-level (Babcicky & Seebauer, 2017; Lo, 2013) action against a range of threats, or mediate cognitive decision-making processes (Wilson, Herziger, Hamilton, & Brooks, 2020). Therefore, there is room to consider questions on self-stated flood recovery using qualitative data on how the respondents place themselves within their socio-normative context.

A related implication concerns the merits of extending empirical surveys of self-stated flood recovery to more countries with differing gender or cultural norms, as well as across different groups within society. Comparing the results of this study and Bubeck and Thieken (2018), we detect that using the core question of self-stated recovery in German or Vietnamese contexts produced similar results. This is taken as an indication that this question and phrasing are transferable, given the different contexts in which the question was tested. However, to truly confirm the degree of intercultural transferability, wider testing across different socio-normative contexts is required. This can also include different groups within society, as it is known that different social groups experience flood impacts differently (Bubeck & Thieken, 2018; Cutter, 2017; Hale, Flint, Jackson-Smith, & Endter-Wada, 2018; Hudson, Thieken, et al., 2019, Hudson, Botzen, et al., 2019, Hudson, Pham, et al., 2019). Therefore, while the flood recovery question used here is suitable for overall recovery, there can be additional nuances for specific social groups. This is because it has shown how social inequalities can result in, for example, socially vulnerable being more heavily impacted by flooding (Hale et al., 2018). This in turn requires more nuanced risk management policies. A related question can ask if the potential differences in endemic flooding across Germany and Vietnam could alter the level of flood resilience and as such the rates of recovery. To answer this question the Vietnamese survey would have to be re-designed to focus on a wider conceptualisation of flood resilience (e.g., resistance and adaptive capacity) rather than focusing primarily on the recovery pillar of resilience.

These activities can form the basis of future research on the way to developing a suitable multi-item index specifically for self-stated flood recovery to improve accuracy. Constructing multi-item values is common in a range of psychometric research fields, for example, Diamantopoulos, Sarstedt, Fuchs, Wilczynski, and Kaiser (2012), Boateng, Neilands, Frongillo, Melgar-Quiñonez, and Young (2018), Robinson (2018). Our study touches upon this topic of improving what is known about the reliability and accuracy of self-reported flood recovery questions and concepts by providing an initial indication of its reliability via consistency in conceptually replicating results in different concepts. This may allow for more of the socio-normative aspects and differences to be accounted for in future studies. For example, attempts could be made to measure how strongly people identify with various gender stereotypes in order to correct/detect any potential underreporting of self-stated recovery that may occur due to different self-perceptions such stereotypes cause (Hebert et al., 1997; Sigmon et al., 2005). Moreover, there can be room for measuring self-stated flood recovery as a multi-item value constructed from different but interconnected recovery concepts (e.g., subjective well-being).

The final potential for future research echoes the call for longitudinal datasets (Bubeck & Botzen, 2013; Hudson, Thieken, et al., 2019, Hudson, Botzen, et al., 2019, Hudson, Pham, et al., 2019; Mondino et al., 2020; Siegrist, 2013). This is especially important regarding self-stated flood recovery, as it is a dynamic concept. While cross-sectional research designs can provide valuable insights, to truly understand self-stated flood recovery across society we need a greater number of research designs that can capture the temporal aspect of recovery in the flood risk domain, as is available for other potentially traumatic events (Galatzer-Levy, Huang, & Bonanno, 2018). Moreover, an additional methodological focus could involve the use of paired respondent studies. The underlying rationale is that households are not individual people, but rather consist of multiple actors (Seebauer, Fleiß, & Schweighart, 2016). Therefore, there can be different levels of self-stated recovery across households, but also among members of the same household as well. A better understanding of how self-stated recovery differs across members of the same household can further refine our understanding of the recovery process, its relation to the members' roles in the household, and thus potential inequalities in recovery. Moreover, an increased focus on longitudinal data collection offers a further way of testing the accuracy of the self-stated flood recovery questions by better connecting these questions with similar concepts.

4 | CONCLUSION

Our objective was to conceptually replicate the study of Bubeck and Thieken (2018), which was based on German data in Vietnam, a different context. This is in order to further investigate and analyse the robustness and generalizability of their findings into individual self-stated flood recovery and associated gender inequalities across the four studied variable domains (i.e., that women display slightly slower recovery levels, and that psychological variables rather than adverse flood impacts most strongly influence the recovery process). This is in line with the growing call for the replication of empirical studies to provide a more secure base of knowledge, as well as the prominence given to gender in international policy objectives.

The results of our analysis highlight a set of potentially important variables regarding the recovery process, for example, perceived impacts of previous flood events and access to help from within and outside of the community. Furthermore, female respondents were affected (slightly) more heavily by flooding and take longer to recover compared to male respondents. Moreover, this is even though the final set of important variables was found to be quite similar across genders (Tables 3, 60% of relevant variables that is, age, level of bonding social capital, access to internal and external support after a flood, perceived severity of previous flood impacts, not being stress resilient), and their potential for explaining recovery differs (Table 2). Therefore, the process through which women and men recover is different and needs further investigation.

Moreover, these results show potential cross-cultural transferability. In both cases (i.e., the current study and Bubeck & Thieken, 2018), despite slight differences, a slower rate of self-stated flood recovery for women was found relative to men. In addition, while in both Germany and Vietnam the ordering of domains was different when all respondents were considered, the psychological domain was the most important driver of recovery and flood impacts the least in both studies. Despite their different flood and social and cultural contexts, we find similar patterns of results and hence conclude that there is a degree of inter-cultural transferability. This is an important finding, because it provides a greater sense of reliability and consistency in regard to how the current question of self-stated recovery is asked in general. Moreover, the conceptual nature of this replication further supports the robustness of this concept. This is because we were able to successfully adapt the question to a different socio-environmental context, with minimal alterations, and provide comparable findings both in relation to gender and the variable domains. However, this is still limited by only actively comparing two cases, further conceptual replication research in a wider range of socio-normative and flood profile regions is required.

There are several implications of this research, the first being that recovery interventions should be designed such that they are more inclusive. Second, as the psychological domain proves to be important for self-stated flood recovery, the psychological consequences of experiencing flood impacts should be investigated further and considered in the design of post-flood support programmes. The third is that further societal differences, for instance across income groups, need to be investigated and integrated into the risk management process by increasing the range and diversity of stakeholders involved. The fourth is that the reliability and/or accuracy of the employed questions on self-stated recovery need to be further explored. This would require a greater focus on longitudinal data collection, and the possible use of multi-item indices or connections with similar concepts.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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