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FIELD REPORT

# NATURAL DISASTER DAMAGES AND THEIR LINK TO COPING STRATEGY CHOICES: FIELD SURVEY FINDINGS FROM POST-EARTHQUAKE NEPAL

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**Abstract:** The 7.8 magnitude earthquake that struck Nepal on 25 April 2015, was the worst natural disaster to hit Nepal since 1900. This article reports field survey findings on earthquake damages and ex-post coping responses adopted by rural households in Sindhupalchowk, Nepal. Subsequently, we conduct empirical analyses to illustrate how earthquake damages influence ex-post coping strategy choices and potentially limit paths to post-disaster recovery. The goal of this empirical demonstration is to underscore the need to cater post-disaster policies in developing countries in ways that expand households' post-disaster coping strategy choices through market and non-market mechanisms. © 2018 John Wiley & Sons, Ltd.

**Keywords:** earthquake; natural disaster; disaster damage; coping; Nepal

## 1 INTRODUCTION Q5

The scope of direct natural disaster damages and a subsequent sequence of indirect effects stemming from those damages have long-lasting impacts on rural households in developing countries (e.g. Baez, de la Fuente, & Santos, 2010; Gignoux & Menéndez, 2016). This deleterious relationship between disaster impacts and long-run economic well-being is of special significance for vulnerable households with low or unreliable access to financial markets and public institutional support and whose pre-disaster subsistence relies heavily, if not fully, on the limited physical capital (land and property)

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and human capital (health and experience) endowments (Sakai et al., 2017). For such households at the cusp of rampant poverty, natural disaster damages can result in a significant loss of productive assets, which can push them into persistent poverty trap (Carter & Barrett, 2006). Often, the impact that these unforeseen shocks have on households' choice of coping responses is a crucial determinant both for short-term rehabilitation and long-run recovery following natural disaster shocks (Carter, Little, Mogues, & Negatu, 2007). As a case in point, Baez et al. (2010), following an extensive review of empirical evidence, conclude that disaster damages can result in substantial depletion of human capital that can have deleterious consequences on current nutrition, health and education status and can severely restrict future income-generating capabilities. A recent study by Sakai et al. (2017) also points out that income shock and loss of assets from disasters not only reduce food and non-food consumption but can severely deteriorate future income streams. As such, it is crucial to examine the intricate relationship between the nature of natural disaster damages and households' coping responses. Understanding this relationship can help guide post-disaster policies towards facilitating the provision or expansion of various market and non-market alternatives to cope with post-disaster challenges.

Many extant studies that examine natural disaster responses from a household perspective use the full consumption insurance hypothesis (henceforth referred to as full-CIH) as a theoretical framework (e.g. Kohara, Ohtake, & Saito, 2002; Sawada & Shimizutani, 2007). In the case of an idiosyncratic shock, full-CIH assumption implies that individuals' consumption should remain unchanged if markets are complete, or there are other mechanisms or institutions in place to implement full-information Pareto-optimal allocation (Cochrane, 1991). The full-CIH counterpart in the case of a covariate shock (such as natural disasters) suggests that households or communities should be able to absorb the disaster impacts if a complete set of market and non-market mechanisms and appropriate institutional support are available (Cochrane, 1991). However, our observations from the field lead us to conclude that a full set of market and non-market mechanisms are unavailable to Sindhupalchowk residents and that households continue to suffer from disaster damages. Therefore, full-CIH assumptions and implications do not hold for this study area. Nonetheless, full-CIH provides a theoretical framework to build a case for the expansion of such market or non-market mechanisms. To that end, this study employs primary household data that we gathered from a 2017 field survey in post-earthquake Nepal to evaluate the link between (the nature of) natural disaster damages and ex-post coping strategy choices that households adopt.

## 2 CONTEXT AND FIELD SURVEY STUDY

The devastating 7.8 magnitude earthquake on 25 April 2015 and a series of even more impactful aftershocks claimed over 9000 lives, destroyed approximately 700 000 homes, displaced millions and decimated many internationally recognised cultural heritage sites and monuments (CRED, 2015). The post-disaster situation in Nepal can be characterised as one embroiled in political turmoil, instability, poor institutional quality and inadequate government response. The 2015 earthquake is the single worst natural disaster in Nepal since 1990, and Sindhupalchowk is the worst affected district (Shakya, 2016). We conducted a field survey across all nine wards in Basbari, Sindhupalchowk, Nepal, in May–July 2017.[1] Even after 2 years of the earthquake, public infrastructures in Basbari





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were still in shambles, and most wards in the survey area had no functional roads and were reachable to us only by feet. Throughout the study period, we conducted interviews with over 500 households, who were selected on the basis of stratified random sample procedure. The field survey was conducted by the leader author of this article with assistance from five enumerators over the period of 11–12 weeks. As discussed elsewhere, our respondents compose of heterogeneous groups belonging to diverse ethnic, cultural and religious backgrounds (Rayamajhee & Bohara, 2018). The majority of households (68 per cent) are engaged in agriculture as their primary occupation, as is the case across rural villages in Nepal; roughly 12 per cent are *Dalits* (lowest group in the Hindu caste hierarchy), and another 40 per cent are *Janajatis* (marginalised indigenous groups). Seventy-one per cent follow Hinduism, and 27 per cent follow Buddhism (Rayamajhee & Bohara, 2018). Each household representative was asked about the levels of house, property/asset and health damages their households experienced as a result of the earthquake. Information on various coping strategies that they adopted was gathered. All strategies were then classified into four types: (i) dissaving (use of saving and distress sale of assets), (ii) borrowing, (iii) labour adjustment (more members in labour force and advance labour) and (iv) private transfer (mutual assistance and remittance). Subsequently, detailed demographic information was also gathered.

## 3 FINDINGS AND DISCUSSION

Table 1 reports earthquake damages: 17 per cent of households experienced direct bodily harm, 89 per cent had home damages, over 93 per cent suffered emotional distressed and so on. Table 2 presents results on coping strategy choices that households adopted in the aftermath of the earthquake. Borrowing, use of savings and labour adjustment are among the most common coping strategies reported. Subsequently, we conduct two set of empirical analyses. Table 3 presents results from ordered probit regression results that assume independence of coping strategy choices of households. In Table 4, we allow contemporaneous correlation across equations for each coping strategy. As Sawada and Shimizutani (2007) note, earthquakes are exogeneous events, and their damages are unexpected shocks, which eliminates endogeneity concerns that could arise in other types of non-random shocks. In this article, we only discuss findings that are consistent across both empirical approaches (Tables 3 and 4). Results suggest that households that experience major house damage are less likely, as compared to households that experience

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Table 1. Percentage of households affected by the 2015 earthquake ($N$ = 510)

| | Completely affected | Partly affected | Not affected |
|---|---|---|---|
| Bodily harm (injury and death) | 11.37 | 5.69 | 82.95 |
| Dwelling facility (loss) | 80.78 | 8.63 | 10.59 |
| Access to food | 12.35 | 21.76 | 65.88 |
| Access to water | 23.97 | 21.41 | 54.62 |
| Earning potential (loss) | 43.81 | 25.15 | 31.04 |
| Mobility | 32.42 | 24.75 | 42.83 |
| Physical assets (loss) | 78.82 | 13.73 | 7.45 |
| Emotional distress | 81.3 | 12.4 | 6.3 |
| Domestic violence (increase) | 9.82 | 8.64 | 81.53 |
| Community engagement | 19.25 | 23.77 | 56.98 |





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Table 2. Percentage of households by ex-post coping strategy choices ($N = 510$)

| Households by type of coping mechanisms adopted | Minor to no effect | Partly affected | Completely affected | All households |
|---|---|---|---|---|
| Dissaving | | | | |
| Distress sale of assets | 0.59 | 5.29 | 8.43 | 14.31 |
| Use of savings | 1.57 | 6.86 | 26.27 | 34.71 |
| Borrowing | 1.96 | 13.53 | 41.37 | 56.86 |
| Labour adjustment | | | | |
| Advance labour | 0.39 | 3.33 | 9.80 | 13.53 |
| More members in labour force | 0.00 | 1.76 | 5.10 | 6.86 |
| Child labour | 0.78 | 4.71 | 12.55 | 18.04 |
| Reduce consumption | | | | |
| Consume less food | 3.33 | 20.00 | 65.88 | 89.22 |
| Consume less non-food items | 3.53 | 20.20 | 64.71 | 88.43 |
| Private transfers | | | | |
| Family/neighbour/patron help | 1.76 | 8.63 | 32.35 | 42.75 |
| Remittance help | 0.78 | 2.16 | 4.90 | 7.84 |
| Public (and quasi-public) transfers | | | | |
| Government help | 3.53 | 20.00 | 62.35 | 85.88 |
| NGO help | 3.73 | 14.71 | 49.22 | 67.65 |
| Other coping strategies | | | | |
| Out-migration | 0.78 | 2.55 | 7.06 | 10.39 |
| Household adopted any coping strategy | 4.51 | 22.94 | 72.16 | 99.61 |



only minor or no house damage, to engage in distress sale of assets and labour adjustment activities (more members in the workforce and advance labour). The negative coefficient for sale of assets is due to the fact that households that experience major damage of their homes also lost their physical assets stored in their homes. Because house damage inevitably engenders efforts to build or seek shelter, it precludes labour market adjustment, which explains the negative coefficients for labour adjustment outcomes. Unlike the case of house damage, households that experience major property damage are able to send more members into the workforce. However, such households are less able to use remittance help (loans or grants) as a coping tool, presumably because rural households use property as collateral to migrate to cities or abroad for remittance income. Table 4 results indicate that these households are also still able to borrow money to cope with disaster impacts, perhaps using their house and/or assets as collateral, but this finding is not robust across alternate empirical approaches (in Table 3). On the other hand, we find that households that experience major health damage engage in borrowing activities and also make necessary labour adjustment by sending additional members into the workforce and by engaging in advance labour as a compensating strategy. We also find that they are less likely to deplete their savings, which highlights their risk-averseness, as health damage inevitably entails the need of savings in future periods.

## 4 IMPLICATIONS

Our observation from the field and subsequent findings from data analysis highlight the failure of public institutions in Nepal to adequately address post-disaster challenges. Following the 2015 earthquake, the Nepali government warned that all external assistance



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Table 3. Ordered probit regression results for various coping strategies

| | Dissaving | | | Labour adjustment | | Private transfers | |
|---|---|---|---|---|---|---|---|
| Variables | Use of saving | Distress sale of asset | Borrowing | More members in labour force | Advance labour | Mutual assistance | Remittance |
| Major house damage (dummy) | 0.143 (0.145) | −0.575*** (0.202) | −0.183 (0.150) | −0.566*** (0.217) | −0.360* (0.208) | 0.000117 (0.0836) | 0.391** (0.162) |
| Major property damage (dummy) | 0.0854 (0.172) | 0.117 (0.188) | 0.257 (0.195) | 0.580* (0.342) | 0.276 (0.217) | 0.246* (0.141) | −0.505*** (0.123) |
| Major health damage (dummy) | −0.445** (0.176) | 0.0462 (0.153) | 0.296** (0.133) | 0.696*** (0.233) | 0.385* (0.221) | −0.0698 (0.213) | 0.0107 (0.173) |
| Constant | 0.140 (0.491) | 0.116 (0.685) | 0.579 (0.451) | 6.887*** (0.701) | 1.425*** (0.548) | 0.387 (0.598) | 1.674* (0.978) |
| Observations | 506 | 506 | 506 | 506 | 506 | 506 | 504 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Controls included in the model are age of household head, education level of household head, marital status, religion, occupation of household head and household assets.
Standard errors are in parentheses.
******$p < 0.01$,
****$p < 0.05$,
**$p < 0.1$,
$^{+}$+$p < 0.15$.




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Table 4. Regression results from simultaneous equation model for various coping strategies

| | Dissaving | | | Labour adjustment | | | Private transfers | |
|---|---|---|---|---|---|---|---|---|
| Variables | Use of saving | Distress sale of assets | Borrowing | More members in labour force | Advance labour | Reduce food consumption | Mutual assistance | Remittance help |
| Major house damage (dummy) | 0.0377 (0.0631) | −0.140*** (0.0456) | −0.0603 (0.0653) | −0.0603* (0.0330) | −0.0737+ (0.0454) | 0.0176 (0.0358) | −0.00239 (0.0666) | 0.0468 (0.0356) |
| Major property damage (dummy) | 0.0367 (0.0617) | 0.0408 (0.0445) | 0.109* (0.0638) | 0.0481+ (0.0323) | 0.0577 (0.0444) | 0.0366 (0.0350) | 0.0813 (0.0651) | −0.0745** (0.0348) |
| Major health damage (dummy) | −0.145** (0.0659) | 0.0132 (0.0476) | 0.101+ (0.0682) | 0.119*** (0.0345) | 0.0910* (0.0474) | 0.0307 (0.0374) | −0.0309 (0.0696) | 0.00642 (0.0372) |
| Constant | 0.407** (0.191) | 0.367*** (0.138) | 0.277 (0.198) | −0.0698 (0.100) | 0.103 (0.138) | 0.953*** (0.108) | 0.392* (0.202) | 0.0734 (0.108) |
| Observations | 506 | 506 | 506 | 506 | 506 | 506 | 506 | 506 |
| $R^2$ | 0.078 | 0.096 | 0.089 | 0.088 | 0.081 | 0.078 | 0.047 | 0.088 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Controls included in the model are age of household head, education level of household head, marital status, religion, occupation of household head and household assets.
Standard errors are in parentheses.
******$p < 0.01$,
****$p < 0.05$,
**$p < 0.1$,
+$p < 0.15$.

to help earthquake victims would be required to channel their funds through the centralised Prime Minister's Relief Fund (Nelson, 2015). The National Integrity Policy that was later put in place with the goal of 'streamlining national and international non-governmental organizations regulation by placing it under a single framework' continues to impose additional regulatory barriers, increases rent-seeking opportunities and may restrict or prevent international organisations from working in Nepal (Pradhan, 2018). Our findings make it abundantly clear that disaster damages pose unique challenges to households and that one-size-fits-all post-disaster policies inevitably fail to account for such idiosyncrasies. An acknowledgement that post-disaster challenges require concerted efforts from all institutions—private, public or otherwise—is a good starting point. Given current inefficiencies and misaligned priorities of public institutions in Nepal, a polycentric approach to post-disaster policies needs to be earnestly explored (Coyne & Lemke, 2011). A multiple set of institutions competing and/or cooperating for the provision of post-disaster assistance, even with all potential duplications and overlapping jurisdictions, can better mobilise local knowledge to provide better post-disaster assistance than the status quo. Only with the adoption of such polycentric approach can we work towards expanding market and non-market alternatives to meet the optimistic assumptions of consumption insurance hypothesis.

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