Natural Disasters, ex-post coping strategies, and post-disaster resilience: Evidence from the 2015 earthquake in Nepal

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Abstract

In the aftermath of natural disasters, households adopt a wide range of coping strategies to overcome post-disaster challenges. Using primary data gathered from a field survey in Sindhupalchowk, Nepal following the 7.8 magnitude earthquake in 2015, this paper investigates the role that households' choice of coping strategies plays in their post-disaster recovery. We measure post-disaster recovery using composite resilience-indices that capture both economic and psychosocial aspects of post-disaster recovery. Because household responses are potentially endogenous, we use a full-information multi-equation regression framework that allows for contemporaneous correlation across equations to account for the processes that determine households' choices. We find strong evidence to suggest that increasing financial access and labor adjustment choices has positive and significant impact on post-disaster economic resilience. On the other hand, while the adoption of financial coping strategies enhances psychosocial resilience, we find that labor adjustment choices can disturb family and social dynamics, thereby negatively impacting psychosocial resilience. Our secondary findings indicate that government assistance can have unintended detrimental impacts on economic resilience, hinting at the subpar quality of political institutions in Nepal. These results underscore the importance of mobilizing and expanding market and non-market alternatives in post-disaster recovery and reconstruction efforts.

Keywords: Natural disasters, shocks, earthquake, coping, resilience, recovery, Nepal

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Introduction

The past few decades have witnessed unprecedented number of natural disasters, both in terms of frequency of occurrences and their impacts on human lives. Between 1994 and 2013, 6873 natural disasters have been reported worldwide that impacted 218 million people on average per year and have cumulatively claimed 1.3 million lives. Along with the frequency of natural disasters, disaster-related death rates have also been rising steadily. The paper centers around the single worst natural disaster since 1900 in Nepal, one of the poorest countries in the world. The devastating 7.8 magnitude quake on April 25, 2015 and dozens of aftershocks that followed, including one of 7.3 magnitude on 12th May, caused destruction to a scale comparable to that of the decade long Maoist insurgency –in terms of lives lost, population affected, and economic costs (CRED 2015a; Joshi 2014). The event claimed over 9,000 lives, affected another 8 million, and resulted in estimated direct and indirect economic losses amounting to 10 billion USD (ibid.). Unlike that of neighboring China, where the government-led response to the 2008 earthquake was reported as being "rapid and massive," Nepali government's response was slow and ineffective, and often hindered multi-agency recovery and relief efforts through bureaucratic hurdles (Rayamajhee and Bohara 2018b; Shi et al. 2013). As Rayamajhee and Bohara (2018b) have noted, the post-disaster situation in Nepal can be described as one embroiled in political instability, poor institutional quality, and inadequate governmental response to remedy disaster losses.

As is often the trend with most low-frequency high-impact disasters, earthquakes in Nepal garnered overwhelming initial attention that gradually faded away as priorities shifted to other issues. Any residual discussions surrounding the earthquake centers around appraisal or critique of public policies and interventions in the aftermath of the shocks. While such evaluation and critical analyses at the upper echelons of policy-making may help prevent bureaucratic blunders

in future shocks, the fact remains that geophysical shocks can neither be predicted nor prevented. In that regard, we deem that a sensible alternative is to refocus our attention to enhancing disaster preparedness and mitigation strategies at the local level. This sentiment mirrors that of the United Nations' Sendai Framework whose key priorities include "enhancing disaster preparedness for effective response and to build back better in recovery, rehabilitation and reconstruction."[1] To that end, we shift our emphasis from disaster responses at high-level institutions to understanding how agrarian households respond *ex-post* to such covariate shocks and how those responses influence their paths to [household] recovery, particularly in developing economies with weak political institutions.

We postulate that, in absence of reliable public institutions, the post-disaster recovery of households largely hinges on their own post-disaster coping strategy choices and localized efforts to tackle post-disaster challenges. To examine such mechanisms, we use the resilience framework that social scientists have borrowed from ecologists (Barrett and Constas 2014). As noted by many, social science adaptations of resilience are often too vague and its applications too discordant and unsystematic to render them meaningful (Klein, Nicholls, and Thomalla 2003; Rose 2007). We address that concern by providing a systematic, quantifiable definition of household resilience that captures both economic and psychosocial dimensions of post-disaster recovery. We retain its original ecology interpretation (Gunderson, Allen, and Holling 2012; Holling 1973; Walker and Salt 2012) but adapt it to a disaster context to reflect household perspective. We define disaster resilience as following:

> In the face of an exogenous shock and the consequential loss in wellbeing, resilience is the ability of a household to bounce back to the original level of wellbeing (or better)

[1] Sendai Framework for Disaster Risk Reduction 2015–203. United Nations (UNISDR 2015 p. 21).

relative to the intensity of the initial impact of shocks.

As such, a household that has suffered a disaster and rebounded from that disaster is a household that, on our definition, has exhibited resilience. This treatment of resilience as an exhibited characteristic rather than a latent property allows for an unambiguous interpretation of our empirical findings, since the 'bouncing back' process is an observable and measurable feature relative to the abstract resilience stock.[2]

This paper makes two important contribution to the literature of disaster resilience and recovery as well as the literature on the ability of households in the poorest communities to overcome negative shocks.[3] First, we provide the first household-survey based quantitative analysis of the impact of the 2015 earthquake on agrarian households in rural Nepal, and track their responses to cope with post-disaster challenges.[4] Secondly, using retrospective questions about post-disaster recovery, we evaluate the role of ex-post coping responses in their post-disaster economic and psychosocial resilience. Unlike previous studies that view resilience exclusively as a collective, community-level feature, this microeconomic treatment allows us to exploit household level variation in recovery measures to identify factors that lead to post-disaster resilience.

Our descriptive results show that reduction in household consumption of food and non-food

[2] Although not applicable to our case, this treatment of resilience implies that a household that has not undergone a disaster shock cannot be included in our analysis. In other words, households that may otherwise be deemed resilient based on observable disaster-preparedness measures and other unobservable characteristics cannot be deemed resilient for our analysis. This can be viewed as a shortcoming of our treatment. Nonetheless, this shortcoming is a reasonable tradeoff as it allows for an unambiguous analysis based on the variation in household recovery across multiple dimensions of well-being.

[3] Notable recent contributions to the literature on this topic include (Aldrich 2012; Chamlee-Wright and Storr 2009; N. M. Storr, Chamlee-Wright, and Storr 2015; V. H. Storr and Haeffele-Balch 2012).

[4] Using a mixed methods approach, Epstein et al. (2018) provide an analysis of post-disaster impacts and adaptation among smallholder communities in Dolakha, Nepal. The study employs *disaster resilience of place* (DROP) framework to assess community resilience Cutter et al. (2008).

items, short-term loans, and mutual assistance are the most common strategies adopted. Although 86% and 68% of households we interviewed report receiving assistance from governmental and non-governmental sources, such assistance remained nominal. In our subsequent analysis, we categorize all household responses into three broader bins: financial coping strategies, labor adjustment choices, and seeking external assistance. Our empirical findings indicate that both financial and labor adjustment coping methods significantly contribute to higher economic resilience. However, when juxtaposing their relative magnitudes, we find that financial coping is relatively more effective. We find strong evidence to suggest that adoption of a financial coping strategy also enhances psychosocial wellbeing of households. On the other hand, labor adjustment, while lucrative from an economic standpoint, severely disturbs family and social dynamics, thereby negatively affecting psychosocial resilience outcomes. Our secondary findings are somewhat bleak: government assistance has statistically significant and negative impact on economic resilience. Moreover, the pervasive network of non-governmental organizations that has proliferated across the country seems to have no significant impact on either economic or psychosocial resilience. This may point to the lack of accountability, and institutionalized corruption that have long penetrated public and quasi-public sectors in Nepal.[5]

The remainder of this paper is organized as follows. In section 2, we provide a brief survey of literature, section 3 discusses data and provides descriptive analysis, section 4 presents empirical analysis, section 5 discusses results and implications, and section 6 concludes.

Previous Studies on Disaster Resilience

[5] Transparency International consistently ranks Nepal among the most corrupt countries in the world. 2017 TI data gives Nepal a score of 31 (0=highly corrupt, 100=clean) ranking it 122/180 (Transparency International 2018). Truex (2011) points out that behaviors such as "petty corruption," "gift-giving," and "favoritism" are deemed acceptable in situations when seeking access to *deserved* services.

A comprehensive investigation of shocks, natural or manmade, requires consideration of all static and dynamic elements. The traditional cost-benefit approach, while important, does not fully incorporate all moving parts. Moreover, momentary but consequential nature of disaster shocks as well as the pervasiveness of non-monetary and intangible yet crucial factors associated with recovery from such shocks have led social scientists to seek out for a broader, dynamic conceptual framework to account for complex feedback-loops and multidimensional nature of human wellbeing. This need for understanding the complexity and multidimensionality of disaster impact and recovery processes has led to a widespread embrace of the concept of 'resilience'(Rose 2007). Even though no consensus exists on the theory of development resilience, the use of the concept of "resilience" to discuss policy objectives is getting increasingly popular (Barrett and Constas 2014). While this has allowed for a flexible, contextual adaptation of the concept, its divergent use in both academic and policy circles has engendered substantial ambiguity and inhibited consistent interpretation.

Extant studies on disaster resilience focus overwhelmingly at the meso- or macro-levels, with an emphasis on cross- community, regional and national differences (Briguglio et al., 2009; Cannon, 2008; Marto et al., 2018; Rose, 2004). Although micro-level variables such as household income and assets, livelihood strategy, private and public transfers and credit access all play important roles in post-disaster recovery (Bruneau et al. 2003; Davies et al. 2013; Sawada 2007), resilience is often treated as a community feature. A seminal study by Cutter et al. (2008) advances the Disaster Resilience of Place (DROP) model to assess disaster resilience. The study uses thirty-six indicators for measuring and monitoring social, economic, institutional, infrastructure, and community capital, which are then used to quantify resilience. The tacit assumption that motivates this approach is that household-level differences, although they can explain micro-level variation, are less important than *community level forces* that determine post-

disaster resilience. While this view can provide important post-disaster policy guidelines in homogeneous communities with well-functioning public institutions, we contend that heterogenous communities in developing countries with weak public institutions require a more granular approach to understanding disaster resilience. This is especially relevant in the context of post-earthquake Nepal characterized by ethnic/caste-based, religious, economic, cultural, and political cleavages (Rayamajhee and Bohara 2018a). Moreover, even a covariate shock (of the same magnitude) affects each household differently and poses unique challenges to each household, which a community-level analysis fails to account for (Rayamajhee and Bohara 2018b).

Rose (2004) proposes a three-tier analytical framework for disaster resilience and highlights the need to conduct studies at all three levels: the micro-level (individuals, households or firms), the meso/mid-level (groups and sectors), and the macro-level (regions, nations). This paper takes the micro-approach and focuses exclusively at the household-level. This approach has a unique advantage in that it provides us detailed insights into households' post-disaster responses, the factors that influence those responses, and the results of specific coping strategies adopted. An extensive body of literature exists that evaluate disaster impacts at the household-level (Gignoux and Menéndez 2016; Halliday 2006; Halliday 2012; Park and Wang 2017). Another strand of microeconomic literature exists that focus on specific coping strategies employed to tackle post-disaster challenges (Del Ninno, Dorosh, and Smith 2003; Mozumder et al. 2009; Novella and Zanuso 2018; Sawada and Shimizutani 2008; Rayamajhee and Bohara 2018b). An adjacent line of research on the poverty trap in development economics shares strong parallels with the notion of disaster resilience (Barrett and Constas 2014; Carter and Barrett 2006). Nonetheless, very few microeconomic studies on natural disasters use the resilience framework explicitly to evaluate household dynamics (Arouri, Nguyen, and Youssef 2015). Furthermore, empirical studies that

combine these three themes – that is, microeconomic studies at the household level that evaluate ex-post coping strategies and their role in post-disaster recovery using the resilience framework – are virtually non-existent. This paper fills that gap in the literature by using primary survey data from post-earthquake Nepal. The survey asked retrospective questions to gather detailed information on ex-post coping strategies and multi-dimensional resilience measures.

Utilizing resilience thinking to frame discussions on disaster recovery serves two distinct purposes. First, it helps reorient discussions on post-disaster policies away from "highly optimized" solutions to adaptability, diversity, and entrepreneurship (Tarko 2017). Rather than pursuing panacea solutions that are optimized to known sources of danger, resilience thinking allows us to look broadly into complex interconnectivities and multi-dimensionality and empowers individuals and communities to adopt flexible strategies that are robust against side effects and unknown sources of danger. Second, it fosters discussions about a multi-tiered, polycentric approach to post-disaster policies that allows for experimentation by multiple actors who can employ competitive and/or cooperative strategies to meet multi-dimensional, intertwined goals (Ostrom 2010). The solutions that emerge from such discourse are diverse, and adaptable to account for interconnected problems and multiple potential outcomes (Smith et al. 2017). In other words, a solution that is deemed 'optimal' based on an evaluation of economic outcomes is not resilient if it increases fragility in psychosocial or other dimensions. For empirical applications to disaster recovery, resilience thinking entails not only evaluating 'bouncing back' processes in terms of multiple-causes-multiple-outcomes framework, but also devising "participatory approach" to institutional design with "multiplicity of institutional arrangements and practices" (Mustafa 2003; Ostrom 1976). In other words, simply cloaking the usual suspect variables using resilience merely as a rhetorical device to reframe old discussions only serves as a distraction.

This paper contributes to the extant literature in three ways. First, we provide a systematic, empirically tractable treatment of household disaster resilience. Second, the study adds to the thin body of literature on the microeconomic treatment of disaster resilience. Third, it takes a multidimensional approach to quantifying disaster resilience that accounts for both economic and psychosocial dimensions of post-disaster recovery.

Conceptual Framework

The links that our study examines comes from Sawada and Takasaki (2017), who provide a comprehensive framework for microeconomic analysis of the disaster-poverty nexus.[6] The framework highlights the centrality of time-frame and duration in situating discussions of policies and strategies to address disaster issues. As such, disaster preparedness and ex-ante risk management (pre-disaster policies) need to be distinguished from impact assessment, disaster aid and relief (short-run policies), and from reconstruction and rebuilding policies (long-run policies). The poor tend to underinvest in ex-ante measures; and, public institutions in developing countries tend to be underprioritize ex-ante risk management (p. 9). Moreover, because developing economies also face dire short-term problems, long-run planning generally remains confined within the pages of policy reports and vision statements. What all this means is that any disaster-related policies in such vulnerable countries inevitably overemphasize immediate/short-run challenges. Our best hope is to expand the policy purview ever so slightly to include some elements of long-term preparedness through an expansion of market and non-market institutions. While disaster-specific components may still receive limited attention, expansion of general components that overlap with disaster-specific ones may increase our

[6] For a detailed diagrammatic depiction of the conceptual framework, please refer to Figure 4 of the paper (Sawada and Takasaki 2017, 8).

chances of addressing some of the bigger challenges.

Among the five disaster-specific components that Sawada and Takasaki (2017) describe, – i.e. disaster damage, aggregate impacts, recovery, pre-disaster management, and disaster aid – studies conducted in developing countries focus overwhelming on disaster aid (Morris and Wodon 2003; Takasaki 2011a, 2011b). On the other hand, systematic studies that focus on how these disaster-specific components interact with private coping decisions and their outcomes are scarce (ibid.). In the case of Nepal, such studies are non-existent. This gap in the empirical literature is alarming considering the critical role that private coping decisions play in household-recovery, particularly in Nepal where public institutions have generally failed to provide basic post-disaster public goods and services. This paper's central contribution lies in filling that gap in the empirical literature. The focus on [relatively short-term] ex-post coping strategies, and specifically on private ones, is grounded on the political reality of Nepal, where grand teleological visions [of society and politics] have only led to destabilization and polarization.

The conceptual framework that we employ for empirical analysis is represented in Figure 1. A household's private coping decisions after a disaster are similar in many ways to those after any non-disaster shocks (Sawada and Takasaki 2017). However, there are additional factors such as asset damages, injuries and death from a disaster can influence the range of choices within the household's feasibility set (Rayamajhee and Bohara 2018b). Chamlee-Wright and Storr (2010) find that community members adopted self-reliant recovery strategies when people did not believe that government could help them. Other influencers include household characteristics and pre-disaster asset levels (particularly financial assets). Subsequently, the choice of private coping strategy is a major determinant of their post-disaster resilience. Where we slightly deviate from Sawada and Takasaki (2017) framework is that we do not restrict our empirical analysis to

economic outcomes. Because there are trade-offs associated with choices of different strategies, an overinvestment in one strategy aimed at a specific outcome inevitably may lead to underinvestment in another strategy. On the other hand, it may be the case that an investment in one strategy with specific aims may also facilitate in the other aim. The precise direction of effects is an empirical question that requires contextual interpretation.

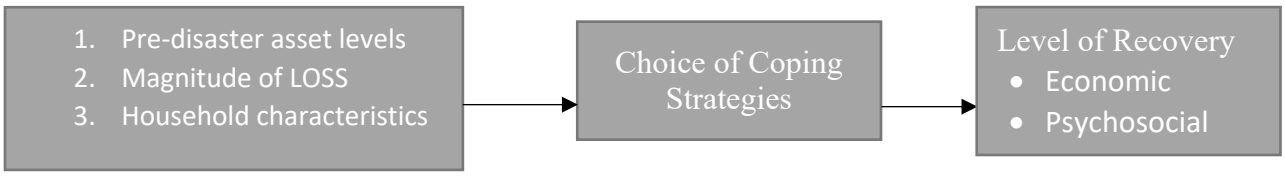

Figure 1: Conceptual Framework adapted from Sawada and Takasaki (2017)

Nepal Earthquake and The Data

Nepal consistently ranks among the 20 most disaster-prone countries in the world. To date, disasters have killed more people in Nepal than in any other South Asian countries (Shakya 2016). The 2015 earthquake in Nepal is the single worst natural disaster since 1900, and Sindhupalchowk is the worst affected district. Shakya (2016) reports that the earthquake claimed 3440 lives in Sindhupalchowk alone, and almost all of the houses in major towns were decimated. The choice of Basbari as the study location was motivated by the fact that many village wards in Basbari have little to no government presence and that post-disaster national reconstruction and rehabilitation initiatives are somewhat of a fairy tale for Basbari residents. International donors and non-governmental organizations also paid very little attention to Basbari as some of the wards (particularly 3, 8, and 9) are among the remotest in the entire administrative district. Apart from basic relief goods and nominal funds to rebuild their homes

(USD 500 to 1000), no household has, up to this point, received any substantive external assistance from any private or public agencies. In many informal conversations with local health workers and some village elders, we heard many tales about the cobweb of bureaucratic hurdles that villagers had to go through even to acquire the limited funds that was already assured to them. This is not surprising considering the post-earthquake situation described as one "embroiled in political turmoil, instability, poor institutional quality, and inadequate government response," and filled with "political wrangling" over leadership of reconstruction agencies (Mishra 2016; Rayamajhee and Bohara 2018b).

The quantitative analyses presented in this paper are based on the data collected by the lead author in May-July 2017, with logistical support from the [institution name omitted for peer review purposes] and [institution name omitted].[7] The field study was conducted across all nine wards in Basbari, exactly two years after the 2015 earthquake. Over 500 households were selected based on stratified randomized sampling procedure, and extensive face-to-face interviews were conducted. As reported by another study in Sindhupalchowk, public infrastructures in rural villages, even two years after the earthquake, are still in shambles (Rayamajhee and Bohara 2018b). During the time of the study, we observed that rural health clinics were forced to operate in dilapidated buildings with no doors and windows; primary schools conducted their classes in nearby *chautaris*.[8]

Table 2 (last section) reports demographic information. Most Basbari households (68%) rely on agricultural production for sustenance, with maize and rice as their major staple foods. Basbari is

[7] This study was conducted to assess the short-run impacts of the 2015 earthquake on rural households in Sindhupalchowk, Nepal, as well as to track their recovery processes. The field survey study also gathered information on food security and health measures.

[8] *Chautaris* refers to peepal-tree shade. They are common meeting places for public discussions in rural Nepal.

a predominantly Hindu (71%) constituency with Buddhism being the second most dominant religion (27%). 40% of the population identify as *Janajatis* (indigenous groups); 12% belong to Dalit-caste (lowest category in the Hindu caste hierarchy). 55% of our respondents are female, and the average household size is 5.6. Compared to regular (extreme weather-related) shocks that Basbari residents face, the 2015 earthquake caused exceptionally high levels of house, property, and health damages. The collected information includes data on self-reported damages caused by the earthquake, household coping strategies after the earthquake, and their recovery status on various wellbeing measures relative to the damage each household suffered.

Earthquake Impacts and Recovery

Bishnu Pokharel [name altered for anonymity reasons], a Basbari resident, notes, "Before the earthquake, many of us were poor and a few were rich, but God does not discriminate…. Whatever differences we may have had in the past, the earthquake evened them all." The earthquake did not spare any households. 89.41% households reported that the earthquake partially to fully damaged their homes. 81% of all homes were completely affected, i.e. they were unlivable without (or even with) major repairs. More than 92% reported having lost physical assets. Although 83% did not face direct bodily harm, results show that 70% lost their earning potential and 94% were emotionally distressed that hampered their economic lives. 34% and 44% households reported that the earthquake hindered access to food and water. The earthquake also impacted social dimensions of wellbeing. 18% households noted an increase in domestic violence attributable to the earthquake; 43% households felt that the earthquake affected their community engagement roles.

Two years after the earthquake, we found that access to water had not improved significantly. Villagers in many remote wards had to commute daily up to several hours to Sindhukhola and Indrawati rivers to fetch water. While the purpose of this paper is not to appropriately test the full consumption insurance hypothesis, we have enough observational evidence to suggest that most Basbari households have been unable to markedly smooth their food and non-food consumption patterns. Figure 1-5 illustrates recovery trends.[9] The vertical line at time *t=24* represents the cut-off point when the data collection took place: towards the left-side of the line are real (stated) recovery rates, whereas towards the right are expected recovery rates. Information on real recovery rates are gathered using retrospective questions. At *t=24*, only 25% had recovered their pre-disaster level incomes. Asset recovery rates at *t=24* is even lower at just 12%. For those households that had not recovered by the time of the study, we asked questions about their expected recovery rates on various wellbeing measures. Figure 1 shows that recovery rates at each time period (including *t>24*) is higher for income than assets, which indicates that asset shocks tend to have more persistent effects than income shocks for rural, agrarian households. 30.41% and 27% households report that they will not be able to recover their pre-disaster level incomes by 2027. On the other hand, Figure 2 shows that 70% of those who suffered physical injuries from the earthquake (excluding those who died) have fully recovered, and almost all households report that they will recover from physical injuries by 2027.

[Insert Figure 1]

[Insert Figure 2]

Coping strategy choices

[9] The estimates presented in figure 1-5 are based on Kaplan-Meier Survival Analysis. For interpretational purposes, survival analysis plots are inverted and presented as failure function graphs – that is, fail to *not* recover. However, to avoid confusion, we avoid the use of the term 'failure' to discuss recovery rates.

Table 1 reports various coping strategies that Basbari households adopted in the aftermath of the earthquake to overcome post-disaster challenges. The use of the word "choice" warrants further qualification. As reported before, one of the most common household coping responses is to reduce consumption of food and non-food items. However, such responses cannot be justifiably called 'choices' in that households do not *choose* to consume less food or other household goods. We deem that it is more appropriate to view such responses as outcomes rather than choices. Moreover, public and quasi-public transfers are not necessarily "choices" as agrarian households in rural Nepal do not have much influence over public programs. That is why, for the empirical estimation in the succeeding section, we treat them as being exogenous from the households' perspective. Among the responses that reasonably qualify as coping strategies, borrowing is the most common response adopted by 57% of all households, followed by mutual assistance (43%), use of savings (35%), and child labor (18%); 14% households resorted to sale of liquid assets; 14% used advance labor, and 7% households reported having to send more members in labor force because of the earthquake. About 8% households were able to mobilize remittance revenue to cope with disasters. 86% households received government assistance, and 68% received some help from non-governmental organizations. Almost all households adopted one or many forms of coping strategies (including help).

[Insert Table 1]

Descriptive Results:

For descriptive analysis (and subsequent econometric analysis), we categorize coping responses into financial and labor adjustment strategies. Financial coping strategies include use of savings, borrowing, and sale of assets, whereas labor adjustment involves advance labor (working in advance with an assurance of a later payment), sending more family members in labor force, and out-migrating for work. Although we consider external assistance from governmental and non-

governmental agencies, we do not classify them as coping strategies. In Figures 3 and 4, we divide the sample based on different coping strategies adopted. Figure 3 shows differences in income and asset recovery rates between households that adopted financial coping strategies and those that did not. Results show that those who adopted at least one financial coping strategy attained their pre-disaster level incomes at a faster pace than those who did not. Among those who have not yet been able to do so, we find that those who adopted financial strategies have higher expectations of faster recovery rates. We find similar trends for asset recovery rates, however the differences are not statistically significant at $t<24$.

[Insert Figure 3]

Figure 4 presents survival analysis results for income and asset recovery rates by labor adjustment strategy. We observe similar trends as that of financial coping strategies. Households that adopted at least one labor adjustment coping strategy have higher income and asset recovery rates (both real and expected). Although the real differences in observed recovery rates is not as pronounced, we find that those who are able to use labor adjustment strategies have higher expectations about income and asset recovery. These differences diverge dramatically after $t=60$.

[Insert Figure 4]

Survival analysis estimates based on government help reveals interesting results. In terms of income recovery, we observe that there is no consistent difference between households that received government assistance and those that did not. However, we see that at t=36, the trends diverge. This indicates that households that received any form of government assistance are more optimistic about their prospects of being able to recover their assets after a year or so. On the other hand, the trend for asset recovery by government assistance reveals interesting results. Households that received government assistance report consistently lower recovery rates compared to those that did not receive any aid. This difference is especially more pronounced

from periods *12<t<84*. The trend reverses at *t>84*. One possible explanation of this reversal could be that there is still hope among Basbari residents that enough government aid will reach to rural Basbari in the next five years or so.

[Insert Figure 5]

The Econometric Model:

The conceptual framework employed in the empirical analysis is represented using a multi-equation system in a recursive modeling set up, where we allow for contemporaneous correlation across equations. The equations employed for empirical evaluation are:

Outcome Equation:

$$Resi_{hh} = \beta_0 + \beta_1 CopingStr_{hh} + \beta_2 HELP_{hh} + \beta_3 X_{hh} + u_{hh} \qquad (1)$$

Decision Equation(s):

$$CopingStr_{hh} = \gamma_0 + \gamma_1 Damage_{hh} + \gamma_2 Access_{hh} + \gamma_3 X_{hh} + V_{hh} \qquad (2)$$

In the first equation, $Resi_{hh}$ represents *Economic Resilience* (ER_{hh}) and *Psychosocial Resilience* (PR_{hh}) of a household. Both *ER* and *PR* are continuous variables ranging from 0 to 20 with higher value representing higher ability to bounce back to the pre-disaster level of economic well-being. $Resi_{hh}$ is determined by a vector of endogenously determined coping strategies ($CopingStr_{hh}$), along with exogenous variables including external assistance ($HELP_{hh}$) and other control variables (X_{hh}) such as initial disaster impact[10], household characteristics, etc. The

[10] We suspect that initial disaster impact is likely to also affect resilience. However, we do not find statistically significant results for house and property damage. Only injury/death seems to hurt recovery, but it is not clear from our analysis if there is a direct channel other than through coping strategy choices. Because we have already

coping strategy decision equation in (2) can be thought of as two separate equations for financial coping ($FinCoping_{hh}$)and labor adjustment ($LaborCoping_{hh}$) strategies. The choice(s) of these coping strategies are determined by disaster damage ($Damage_{hh}$), access to market ($Access_{hh}$[11]), and the same set of household characteristics from equation (1). $Damage_{hh}$ is a matrix of variables representing house, property, and health damages by the earthquake. $Access_{hh}$ includes two variables: distance to the nearest market, and membership in local finance groups. V_{hh}=[v_{hh}, w_{hh}] are error terms for $FinCoping_{hh}$ and $LaborCoping_{hh}$ equations (referred below as equations 2 and 3). βs, γs, and δs are parameters that are to be estimated. The empirical framework employed for this analysis allows for contemporaneous correlation across equations, although we suspect that equations (2) and (3) may not have strong correlations relative to equations (1) and (2) or (1) and (3). These two categories of coping strategies do not contemporaneously covary.[12] That is, coping strategy choices are independently determined, thereby justifying our use of the term *decision*. As the processes represented in these equations occur concurrently, we simultaneously estimate all three equations, assuming error terms follow a multivariate normal distribution such that:

$$\in = [u_{hh}, V_{hh}] = [u_{hh}, v_{hh}, w_{hh}] \sim N(0, \Sigma) \text{ where, } \Sigma = \begin{bmatrix} \sigma_{11}^2 & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & 1 & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & 1 \end{bmatrix} \quad (4)$$

Results:

controlled for household assets/wealth and other characteristics, they at least partly account for house/property damage. That is, the more assets/property a household owns, the higher the earthquake damage. Our results in the subsequent section are robust to inclusion or exclusion of initial disaster impact in equation (1). We report results without it based on model fitness comparison.

[11] It is assumed (and statistically verified) that $Access_{hh}$ is correlated with $CopingStr_{hh}$ and uncorrelated with $Resi_{hh}$. F-test validates the strength of these variables. Also, rank and order conditions are satisfied for identification.

[12] *atanrho* values for equations 2 and 3 are not statistically significant. Although not reported in the paper, full-parameter estimates for all models (tables 3-8) can be made available in the online appendix.

Table 2 provides descriptive statistics of variables employed for econometric analysis in this section. We define economic resilience as a composite score based on four indicators of economic recovery: income recovery, asset recovery, rebuilt houses, and regained pre-earthquake consumption levels. Psychosocial resilience variable is constructed similarly using four indicators: recovery from emotional distress, recovery from EQ-induced domestic violence/aggressive tendencies, re-able to socialize, able to reengage in community. Both economic and psychosocial resilience variables have values that range from 1-20.[13]

[Insert Table 2]

Economic Resilience

Table 3 provides simultaneous equation model estimates of the impact of household coping mechanisms on economic resilience. To confirm that robustness of our estimates, we employ five different model specifications. Model 1 includes results for financial coping methods, while also controlling for household characteristics. Results indicate that adoption of financial coping mechanisms results to an increase in economic resilience of households by 4.74 points. In model 2, when labor adjustment coping is added to the baseline model, we find that the impact of financial coping strategy remains consistent. Labor adjustment coping mechanism also has a significant and positive impact on economic resilience, albeit the impact is lower than that of financial method.[14] Model 3 further includes government assistance. We find that it has negative impact of economic resilience. This result remains consistent when more controls are added in the subsequent model specifications. Model 4 also considers non-governmental organization

[13] Alternate measures of aggregating ER and PR are employed for robustness purposes (not reported in the paper). Results remain consistent.

[14] For robustness purposes, an additional interaction variable for both coping strategy types (*FinCoping*LaborAdjustment*) is included. Results remain consistent. Magnitude for financial coping variable changes slightly, but the narrative still holds. The coefficient for the interaction term is negative (and significant at the 0.1 level) suggesting that there may be a cost to adopting diverse types of strategies. We do not delve into this further.

(NGO) assistance. We find that NGOs have no significant role in enhancing economic resilience. This can be because of a host of reasons. There is a systemic lack of oversight on NGO operations and regulations on NGO programs are virtually non-existent. Moreover, local NGOs have minimal resources and their scopes are limited to a narrow subgroup. Model 5 further includes remittance as an additional control. We find that it has positive (and significant) impact on economic resilience. Inclusion of remittance does not affect the consistency of our results. Throughout all specifications (Models 1-5), results remain consistent. We can safely ascertain that strengthening financial access and availability of labor market opportunities can enrich economic lives of households in the face of covariate shocks such as earthquakes. The role of government, although crucial in most cases, is highly sensitive to the quality of political institutions and norms. Centralized rehabilitation policies with inadequate considerations of local dynamics can engender false hopes among households that can wrongly incentivize vulnerable households and preclude them from adopting other self-reliant measures.

[Insert Table 3]

In Table 4, we look at each financial coping strategy to evaluate their relative impacts on economic resilience. Model 1 presents results for any total financial coping strategies adopted, whereas models 2-4 reports results for sale of assets, borrowing, and use of savings respectively. We find that all three financial coping strategies (sale of assets, borrowing, and use of savings) have comparable impacts on the economic recovery of households. The fact that the joint impact of all three strategies is significantly higher than that of each strategy indicates the cumulative contribution of such strategies is positive. That is, if households are able to adopt a variety of financial coping strategies, that seems to positively impact economic resilience. Table 5 reports findings on labor adjustment coping strategies. Unlike financial coping strategies that have consistent (and positive) effects on economic resilience, labor adjustment impacts vary by types.

Households that send more members to labor force for additional income seem to have higher levels of economic resilience. On the other hand, advance labor (working in advance with an assurance of a later cash or in-kind payment) has negative impacts on economic resilience. To explain this, one needs to first understand the in-kind labor-exchange system prevalent in rural Nepal. Because modern property rights and market mechanisms are not well established in agrarian communities, *khetala-pratha*, a form of traditional labor-exchange system is in place. In such system, a household will send one or more members to work for their neighbors in farming and agriculture, who will later also work for them in return. This in-kind labor exchange system is facilitated by social norms of reciprocity and mutual assistance, which in times of disasters dictate that a less-affected (but affected nonetheless) household would have to assist those who are more-affected. This can have detrimental short-term impacts on their own economic recovery. On the other hand, promises of later payment is not credible when almost everyone involved in contracts have been severely affected by the earthquake. Therefore, by participating in advance labor, a household may be making a bad investment of human capital (or 'wasting' so to speak). We do not observe significant impacts of *out-migration for work* on economic resilience. First, out-migration takes financial resources, which takes away resources that could be directly used for economic recovery. Secondly, it can take a year or two to start saving enough to contribute towards economic recovery. Out-migration is often a long-term labor adjustment strategy, the effects of which may take several years to manifest.

[Insert Table 4]

[Insert Table 5]

Psychosocial Resilience

Estimates of the impact of various household coping mechanisms on psychosocial resilience are reported in Table 6. Following similar strategy, we employ multiple model specifications to test

the sensitivity of financial and labor adjustment coping strategies. Model 1 only includes financial coping strategy as an explanatory variable, while also controlling for various household characteristics. In addition to enhancing economic resilience (as discussed earlier), we find that financial coping also enriches psychosocial lives of households. Results from Model 1 indicate that adoption of financial coping measures leads to an increase in psychosocial resilience by 3.1 points. In model 2, labor adjustment coping is added to the baseline model. We find that the impact of financial coping remains stable, and that of labor adjustment is negative and significant. Since psychosocial resilience reflects the emotional and social aspect of wellbeing, this negative impact is not unexpected. Having to adjust family's labor market involvement constraints social involvement. As more household members join the labor force for more time, social lives are detrimentally impacted. Within the household, this can disturb the pre-disaster level harmony and can cause emotional distress. Note that when we gradually add other variables in models 3 to 5, this result remains consistent. In Model 3, we add government assistance to the model specification in column 3. We find that government assistance has no significant impact on psychosocial lives of rural households. Model 4 further considers NGO assistance. Similar to government, NGOs also do not have any significant impact. Furthermore, remittance, while helpful from economic point of view, does not contribute to psychosocial wellbeing in households struggling with post-disaster challenges (Model 5).

[Insert Table 6]

Table 7 breaks down results by different types of financial coping strategies. Results are consistent across all three financial strategies, namely sale of assets, borrowing, and use of savings. Comparison of these three strategies show that households that (are able to) use savings to cope with post-disaster challenges have the highest psychosocial recovery levels, whereas those that (have to) borrow money have the lowest (but positive) psychosocial recovery levels. In

table 8, we present results by different labor adjustment strategies. Findings show that sending more family members to labor force negatively impacts psychosocial recovery. This is consistent with our findings reported in table 6. On the other hand, we do not find statistically significant relations between the other types of labor adjustment strategies and psychosocial resilience.

[Insert Table 7]

[Insert Table 8]

Discussion of Results

This is among the first microeconomic studies that use the resilience framework to understand post-disaster recovery processes in Nepal. The analyses presented in this study reveals disconcerting realities about the role of government's post-disaster policies in Nepal. The government accumulated billions of dollars in assistance from international donors for post-disaster reconstruction, recovery, and rehabilitation efforts (Bhujel 2017). However, our observation in the field and findings from data analysis shows that post-disaster public policies and aid dissemination have only served to decelerate economic recovery of households. Descriptive results in Table 4 shows that disaster aid dissemination has been haphazard with no accounting of earthquake damages and household needs. Government's approach has been towards centralizing all efforts, as reflected in the mandate to "channel [all] external assistance through the Prime Minister's Relief Fund" (Nelson 2015). When we consider the fact that Nepal consistently ranks among the most corrupt countries in Asia, the creation of a centralized National Reconstruction Authority (NRA) to control all aspects of post-disaster policies with the purported intent of "streamlining national and international non-governmental organizations regulation by placing it under a single framework" can hardly be evaluated optimistically (Pradhan 2018).

Our findings highlight the importance of financial access in enhancing post-disaster resilience. If households are able to borrow money from formal and informal sources and/or sell their liquid assets, they are not constrained into adopting 'bad' coping alternatives such as reducing consumption or sale of productive assets. That is not to say that all forms of financial institutions are uniformly beneficial. Post-disaster policies should remain vigilant against predatory financial institutions that can push agrarian households to adopt measures that can further exacerbate disaster impacts. Moreover, labor market alternatives open up new possibilities of exchanging their knowledge and skills for resources needed for economic recovery. However, our findings indicate that labor adjust involves a critical trade-off between economic and psychosocial wellbeing. When additional household members participate in the labor force or current members in the labor force work longer hours, family and social dynamics are affected. This can happen because of two possible reasons. First, the traditional norms built on caste-based hierarchy stigmatizes *Brahmin* or *Chettri* households from taking jobs that are traditionally perceived as belonging to *Dalits*. Second, these communities are governed by Hindu-patriarchal norms where adult males are breadwinners. Anecdotal stories about household members out-migrating to many Gulf countries to take these *inferior* jobs and adult females entering labor force are abundant. This can have serious negative consequences on their psychosocial recovery. Whether or not this trade-off is worthwhile can only be determined by the specific household. Any post-disaster public policy that attempts to influence those decisions suffers from "the knowledge problem" (Sobel and Leeson 2007). The more complex the challenge, the more difficult the tasks of prediction and top-down control become. As a consequence, the very solution to one problem ends up increasing vulnerability in other aspects (Holling 1996).

In the face of massive public institutional failure to address post-disaster challenges, the sustenance and recovery of Nepalese households rest primarily on their own choice of coping

strategies – especially so in rural districts that are largely invisible to international donors, government agencies, and journalists. In that regard, understanding households' choice of coping strategies at both at both individual and collective levels is crucial in that it provides us a window into their recovery processes. Our findings serve an important purpose of informing what ex-post coping strategies households adopted, what worked, and what did not work. By considering both economic and psychosocial lives of households in assessing resilience, we are able to demonstrate that strategies that are deemed effective in enhancing one aspect of wellbeing do not necessarily translate into other dimensions. These inherent trade-offs are highly idiosyncratic and correspond to each household's unique circumstances. Therefore, our findings should not be interpreted to conclude that a specific coping strategy or a set of strategies is/are *the* panacea(s). In fact, our recommendation is precisely the opposite. The purpose of identifying coping strategies and their relative efficacies in enhancing post-disaster resilience is to present a case for expanding market and nonmarket choices that are available to households. Any policies directed towards that goal need to emphasize on a) establishing and strengthening institutions that facilitate market exchanges, and b) cultivating political culture that fosters the coexistence of a multitude of formal and informal institutions and agencies – private, public, or quasi-public – that compete and/or cooperate for the production and provision of various goods and services.

Conclusion

From a purely academic point of view, natural disasters provide exogeneous sources of variation that naturally interests all social scientists. When existing infrastructures and institutions collapse, there are economic, social, and political ramifications that not only permeate through all sectors of human society but also penetrate into cultural and psychological dimensions. We are then forced to rethink our intellectual frameworks, dissolve our disciplinary walls, and

reengage in ways that transcend narrow disciplinary theorizing so as to understand and overcome existential threats. The adoption of resilience thinking from ecology into disaster studies stems from an explicit or implicit acknowledgement of such interactive and dynamic nature of social, political, and economic institutions and the natural world under which humans make decisions (Smith et al. 2017). In that regard, one distinctive feature of resilience thinking is that it cannot be confined within disciplinary constraints. By shifting focus away from *one maximization problem-one equilibrium* approach to a framework that accommodates multiple agents, multiple institutions, multiple problems, multiple approaches, and multiple solutions, resilience thinking can open up new avenues of intellectual discourse and policymaking.

Resilience thinking of disaster policies has two implications. First, instead of the thin model of rationality frequently often employed to characterize individuals, it [resilience thinking] compels us to elevate them to "fallible but capable" adaptive beings incessantly engaging in continuous learning and error-correcting processes (Aligica and Boettke 2011) and continually adapting to changing circumstances and new risks (Mechler 2016). This dignified treatment of individuals calls for a participatory approach to post-disaster policy formulation and implementation with inbuilt provisions of revisions and reformulations to fit changing needs (Mustafa 2003). Second, in the face of interconnected problems and multiple potential outcomes, solutions must be flexible and adjustable to account for their unintended externality effects (Smith et al. 2017). Gunderson and Holling (2002) emphasize "adaptive management" for the governance of a socioecological system. Such governance requires a political culture that fosters co-existence and collaboration across multiple agents and organizations representing private, public, and quasi-public sectors. Just like a thriving ecological system that emerges from numerous interactions across multiple species competing and cooperating to adapt to the external environment, a human

society based on adaptive management is necessarily polycentric, with multiple loci of power at differing scales (Ostrom 1998).

This polycentric approach to public policy is especially relevant in the context of post-earthquake Nepal characterized by ethnic/caste-based, religious, economic, cultural, and political cleavages (Rayamajhee and Bohara 2018a). Moreover, even the same covariate shock affects each household differently and poses unique challenges to each household (Rayamajhee and Bohara 2018b). If we consider our findings that a) the same coping strategy that has positive impact on one outcome (economic resilience) can have adverse effects on the other outcome (psychosocial resilience), and b) haphazard government policies can hurt, then we are led to conclude that lump-sum policies funneled through one bureaucratic channel can hinder overall post-disaster recovery. That can be devastating to the poor who are particularly susceptible to natural disasters (World Bank and United Nations 2010) and face disproportionate disaster damages (Sakai et al. 2017). Even though there is an overwhelming consensus that better post-disaster policies can significantly improve people's welfare (Skoufias 2003), what constitutes a 'better' policy in countries that are mired in institutionalized corruption and inefficiencies is not clear. The direction that this paper recommends is not one that involves further consolidation of the already ineffective monolithic National Reconstruction Authority (NRA) but one that fosters cooperation and/or competition among multiple autonomous agencies across private, public, or quasi-public domains with varying, even overlapping jurisdictions. Within such polycentric arrangements, policy makers and stakeholders can experiment with diverse approaches within their independent jurisdictions. When one small system fails, another can still operate; and when all small systems fail, larger systems can be called upon (Elinor Ostrom 2003, interviewed by Aligica). Only such people-oriented recalibration of post-disaster policies is consistent with the

disaster resilience framework, and can foster adaptive mechanisms that are immune to sudden changes in local conditions.

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Table 1: Households by ex-post coping strategies adopted (N=510)

Coping Strategies adopted	Percentage of households
Financial Coping Strategies	
Sale of assets	14.31
Use of savings	34.71
Borrowing	56.86
Any	70.58
Labor Adjustment Strategies	
Advance Labor	13.53
More members in Labor force	6.86
Household member migrated for work	10.39
Any	23.73
Private Transfers	
Family/neighbor/patron help	42.75
Remittance help	7.84
Public (and quasi-public) Transfers	
Government help	85.88
NGO help	67.65
Any	91.37
Household adopted ANY coping strategy (incl. help)	99.61

Table 2: Descriptive Statistics of Variables

VARIABLES	Description	Mean	S.D.
Dependent Variables			
Economic Resilience (ER)	Composite Index representing ability to bounce back to the original level of economic wellbeing [range 0 to 20]	13.05	(2.384)
Components of ER*	Regained pre-disaster level income? [0-5]	3.771	(0.995)
	Recovered lost assets or equivalent? [0-5]	2.039	(1.037)
	Rebuilt house? [0-5]	3.186	(1.383)
	Regained pre-EQ level food consumption level? [0-5]	4.059	(0.837)
Psychosocial Resilience (PR)	Composite Index representing ability to bounce back to the original level of psychosocial wellbeing [range 0 to 20]	14.81	(2.438)
Components of PR*	Recovered from emotional distress? [0-5]	3.143	(1.283)
	Recovered from domestic violence/aggressive tendencies? [0-5]	3.699	(0.993)
	Re-able to socialize with family, friends, neighbors? [0-5]	4.259	(0.695)
	Re-able to engage in community? [0-5]	3.709	(1.057)
Explanatory variables			
Ex-post Coping Mechanisms	Binary Variables unless indicated otherwise		
Financial Coping	Total number of financial coping strategies adopted (0, 1, 2, 3)	1.058	(0.857)
Sale of assets	Sale of productive and non-productive assets	0.143	(0.351)
Use of savings	Use of pre-disaster Savings	0.347	(0.477)
Borrowing	Borrowing from institutional and personal sources	0.569	(0.496)
Labor Adjustment	More household members in the labor force; Advance labor	0.151	(0.358)
Private Transfers	Receive help from friends/relatives/neighbors; Remittance help	0.490	(0.500)
External help (Govt, NGOs)	Receive help from government, NGOs	0.925	(0.263)
Disaster Damages			
House Damage	Equals 1 if household experienced major house damage	0.808	(0.394)
Property Damage	Equals 1 if household experienced major property damage	0.788	(0.409)
Health Damage	Equals 1 if household experienced major health injury/death	0.114	(0.318)
Social Participation			
Microfinance	Participation in microfinance group (1 if yes)	0.493	(0.500)
Household Characteristics			
Household size	Number of members in the household	5.606	(2.265)
Age of household head	Age of the household head	47.95	(14.13)
Female	Gender=1 if female	0.555	(0.497)
HH Head Education	*Education Level of household head* No Education=1 Primary Completed=2 Secondary and Higher=3	1.580	(0.592)
Marital Status-married	Equals 1 if married	0.839	(0.368)
Religion-Hindu	Equals 1 if Hindu	0.714	(0.452)
Caste-Brahmin/Chhetri	Equals 1 if Brahmin or Chhetri	0.420	(0.494)
Occupation-Agriculture	Equals 1 if the household head's occupation is agriculture	0.688	(0.464)
Asset	Asset index based on household assets owned (PCA generated)	2.862	(1.435)
Observations		510	

Table 3: Simultaneous Equation Model Results for Economic Resilience

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Financial Coping Strategies	4.743***	4.351***	4.253***	4.246***	4.315***
	(1.219)	(0.690)	(0.762)	(0.766)	(0.774)
Labor Adjustment Coping Strategies		2.079***	2.172***	2.220***	1.861**
		(0.688)	(0.637)	(0.618)	(0.767)
Government help			-0.557***	-0.496**	-0.496**
			(0.207)	(0.195)	(0.195)
NGO help				-0.198	-0.199
				(0.160)	(0.156)
Remittance					0.582**
					(0.280)
Constant	9.005***	8.783***	9.157***	9.187***	9.253***
	(1.548)	(1.390)	(1.447)	(1.456)	(1.507)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	508	508	508	508	508

Controls included in the model are: age of household head, education level of household head, Marital Status, Religion, Occupation of household head, household assets. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15

Table 4: Simultaneous Equation Model Results for Economic Resilience by different financial coping strategies

VARIABLES	Model 1 ER	Model 2 ER	Model 3 ER	Model 4 ER
Financial Coping Strategies (total)	4.031***			
	(0.766)			
Sale of assets		2.946***		
		(0.488)		
Borrowing			2.838***	
			(0.869)	
Use of savings				2.982***
				(0.503)
Labor Adjustment Strategies	1.880**	2.677***	2.648***	2.518***
	(0.778)	(0.327)	(0.592)	(0.356)
Government help	-0.458**	-0.576**	-0.545***	-0.573***
	(0.189)	(0.228)	(0.200)	(0.193)
NGO help	-0.184	-0.176	-0.229	-0.188
	(0.166)	(0.140)	(0.158)	(0.146)
Remittance	0.551*	0.501**	0.479	0.401
	(0.291)	(0.224)	(0.299)	(0.258)
Constant	9.457***	12.21***	12.00***	11.42***
	(1.435)	(0.972)	(0.838)	(0.639)
Observations	508	508	508	508
Controls	Yes	Yes	Yes	Yes

First stage results are omitted for presentational simplicity. Controls included in the model are: age of household head, education level of household head, Marital Status, Religion, Occupation of household head, household assets. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Simultaneous Equation Model Results for Economic Resilience by different labor adjustment coping strategies

VARIABLES	Model 1 ER	Model 2 ER	Model 3 ER	Model 4 ER
Labor Adjustment Coping Strategies	1.880**			
	(0.778)			
More family members in labor		1.602*		
		(0.930)		
Advance labor			-1.824*	
			(1.100)	
Household member migrated for work				0.334
				(1.309)
Financial Coping Strategies	4.031***	4.494***	4.152***	4.329***
	(0.766)	(1.261)	(1.372)	(1.199)
Government help	-0.458**	-0.427**	-0.422**	-0.449**
	(0.189)	(0.187)	(0.202)	(0.197)
NGO help	-0.184	-0.198	-0.177	-0.178
	(0.166)	(0.168)	(0.181)	(0.182)
Remittance	0.551*	0.552**	0.558*	0.593**
	(0.291)	(0.263)	(0.291)	(0.285)
Constant	9.457***	9.333***	10.56***	9.721***
	(1.435)	(1.562)	(1.946)	(1.718)
Observations	508	508	508	508
Controls	Yes	Yes	Yes	Yes

First stage results are omitted for presentational simplicity. Controls included in the model are: age of household head, education level of household head, Marital Status, Religion, Occupation of household head, household assets. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Simultaneous Equation Model Results for Psychosocial Resilience

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Financial Coping Strategies	3.080***	3.077***	3.053***	3.020***	2.998***
	(0.746)	(0.665)	(0.674)	(0.667)	(0.668)
Labor Adjustment Coping Strategies		-2.568***	-2.541**	-2.600**	-2.555**
		(0.959)	(1.002)	(1.030)	(1.039)
Government help			-0.0866	-0.217	-0.223
			(0.356)	(0.291)	(0.292)
NGO help				0.420	0.416
				(0.310)	(0.303)
Remittance					0.289
					(0.287)
Constant	11.31***	11.99***	12.05***	12.02***	12.04***
	(1.106)	(1.239)	(1.228)	(1.259)	(1.260)
Controls	Yes	Yes	Yes	Yes	Yes
Observations	508	508	508	508	508

Controls included in the model are: age of household head, education level of household head, Marital Status, Religion, Occupation of household head, household assets. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1, + p<0.15

Table 7: Simultaneous Equation Model Results for Psychosocial Resilience by different financial coping strategies

VARIABLES	Model 1 PR	Model 2 PR	Model 3 PR	Model 4 PR
Financial Coping Strategies	3.763***			
	(0.631)			
Sale of assets		3.835***		
		(0.337)		
Borrowing			2.947***	
			(0.345)	
Use of savings				4.166***
				(0.459)
Labor Adjustment Strategies	-2.558***	-3.968***	-2.948***	0.264
	(0.945)	(0.761)	(0.911)	(6.218)
Government help	-0.116	-0.163	-0.164	-0.243
	(0.301)	(0.271)	(0.314)	(0.321)
NGO help	0.436	0.503*	0.466	0.421
	(0.304)	(0.285)	(0.323)	(0.261)
Remittance	0.223	0.245	0.295	0.204
	(0.291)	(0.281)	(0.281)	(0.224)
Constant	11.33***	14.25***	13.90***	11.99***
	(1.302)	(1.319)	(1.184)	(2.253)
Observations	508	508	508	508
Controls	Yes	Yes	Yes	Yes

First stage results are omitted for presentational simplicity. Controls included in the model are: age of household head, education level of household head, Marital Status, Religion, Occupation of household head, household assets. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Simultaneous Equation Model Results for Psychosocial Resilience by labor adjustment strategies

VARIABLES	Model 1 PR	Model 2 PR	Model 3 PR	Model 4 PR
Labor Adjustment Strategies	-2.558***			
	(0.945)			
More family members in labor		-2.351*		
		(1.245)		
Advance labor			-2.550	
			(1.744)	
Household members moved away				1.628
				(2.546)
Financial Coping Strategies	3.763***	3.876***	3.374***	3.687***
	(0.631)	(0.530)	(0.735)	(0.645)
Government help	-0.116	-0.125	-0.0847	-0.110
	(0.301)	(0.278)	(0.311)	(0.310)
NGO help	0.436	0.406	0.394	0.414
	(0.304)	(0.285)	(0.288)	(0.287)
Remittance	0.223	0.127	0.130	0.201
	(0.291)	(0.237)	(0.242)	(0.321)
Constant	11.33***	10.90***	11.99***	10.83***
	(1.302)	(1.402)	(1.825)	(1.630)
Observations	508	508	508	508
Controls	Yes	Yes	Yes	Yes

First stage results are omitted for presentational simplicity. Controls included in the model are: age of household head, education level of household head, Marital Status, Religion, Occupation of household head, household assets. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Kaplan Meier Survival Analysis Graphs

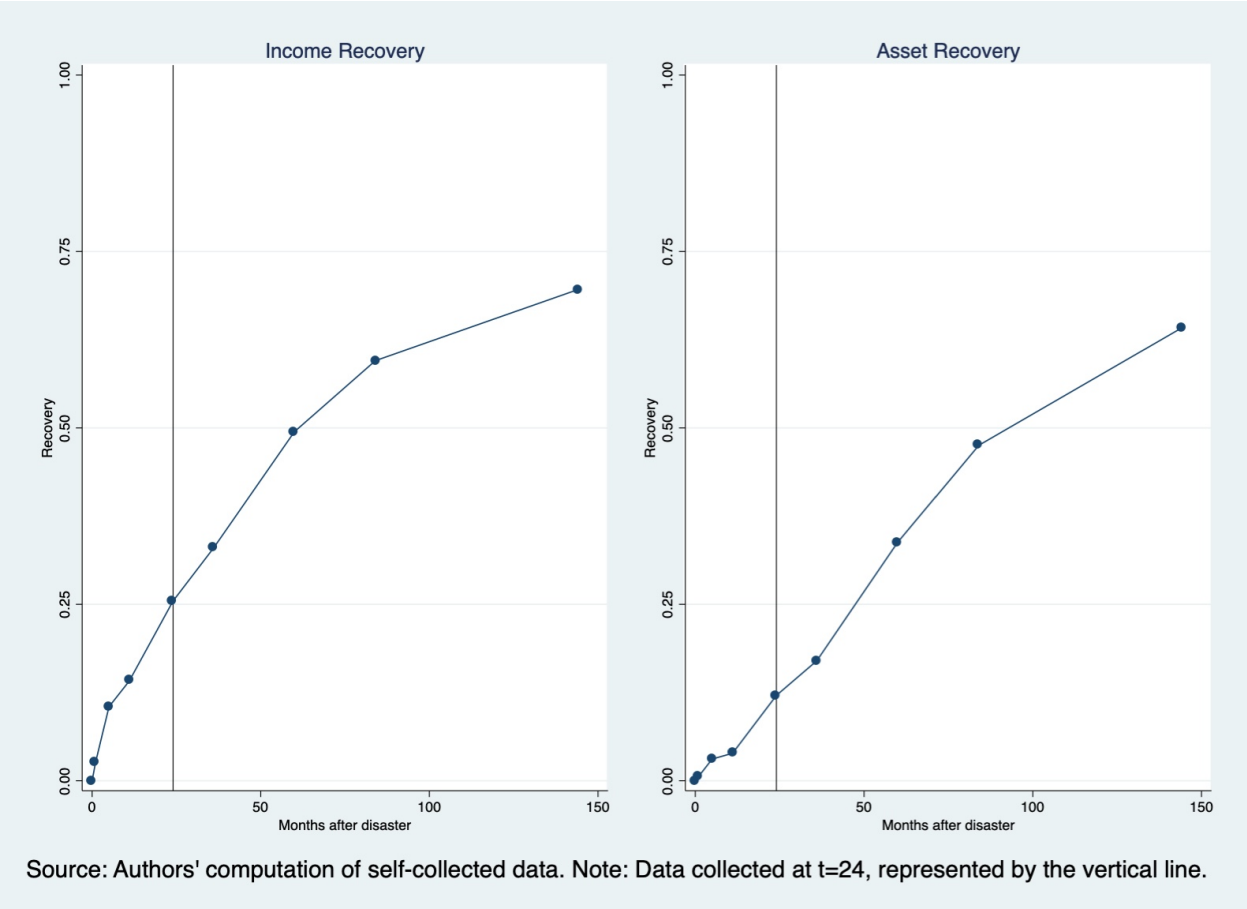
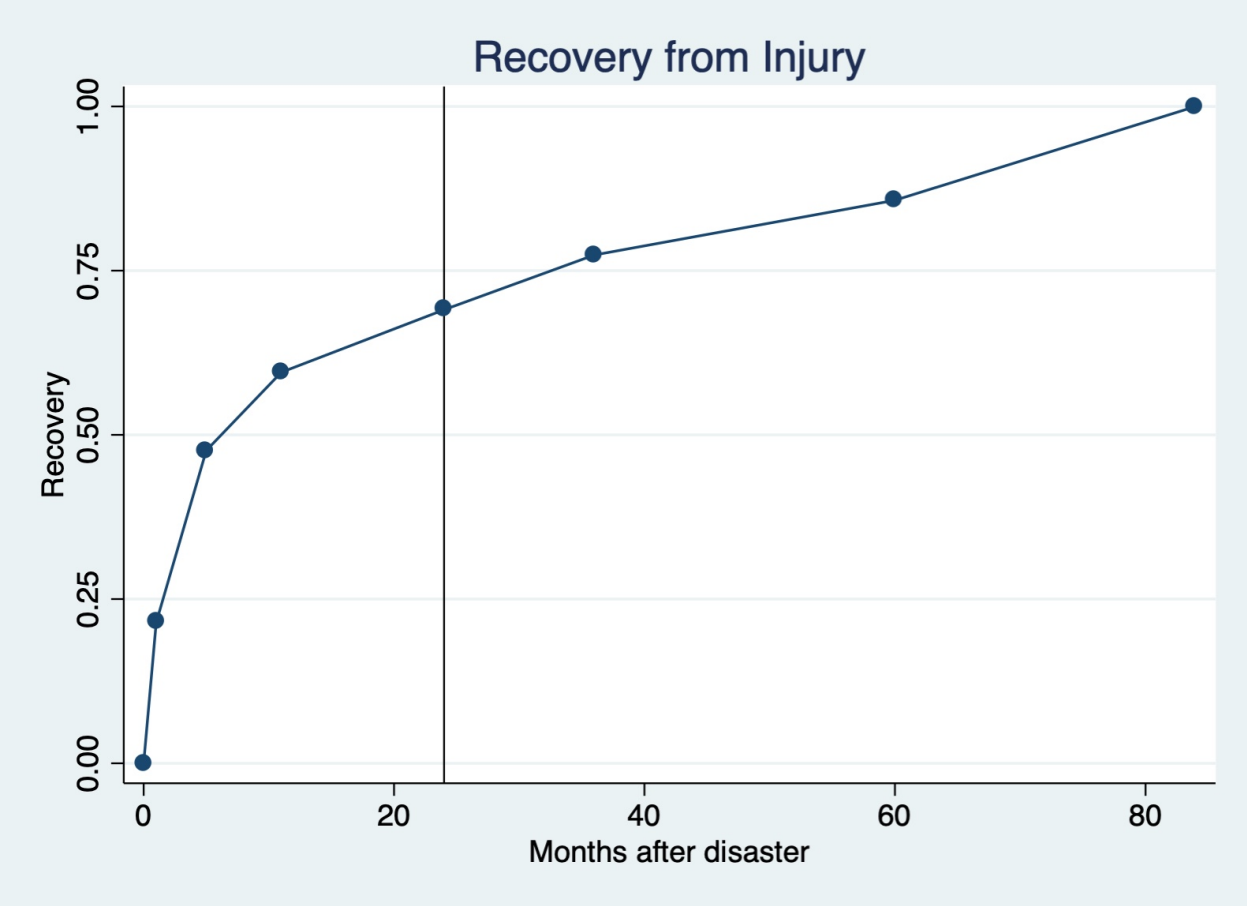


Figure 1


Recovery from Injury
Recovery
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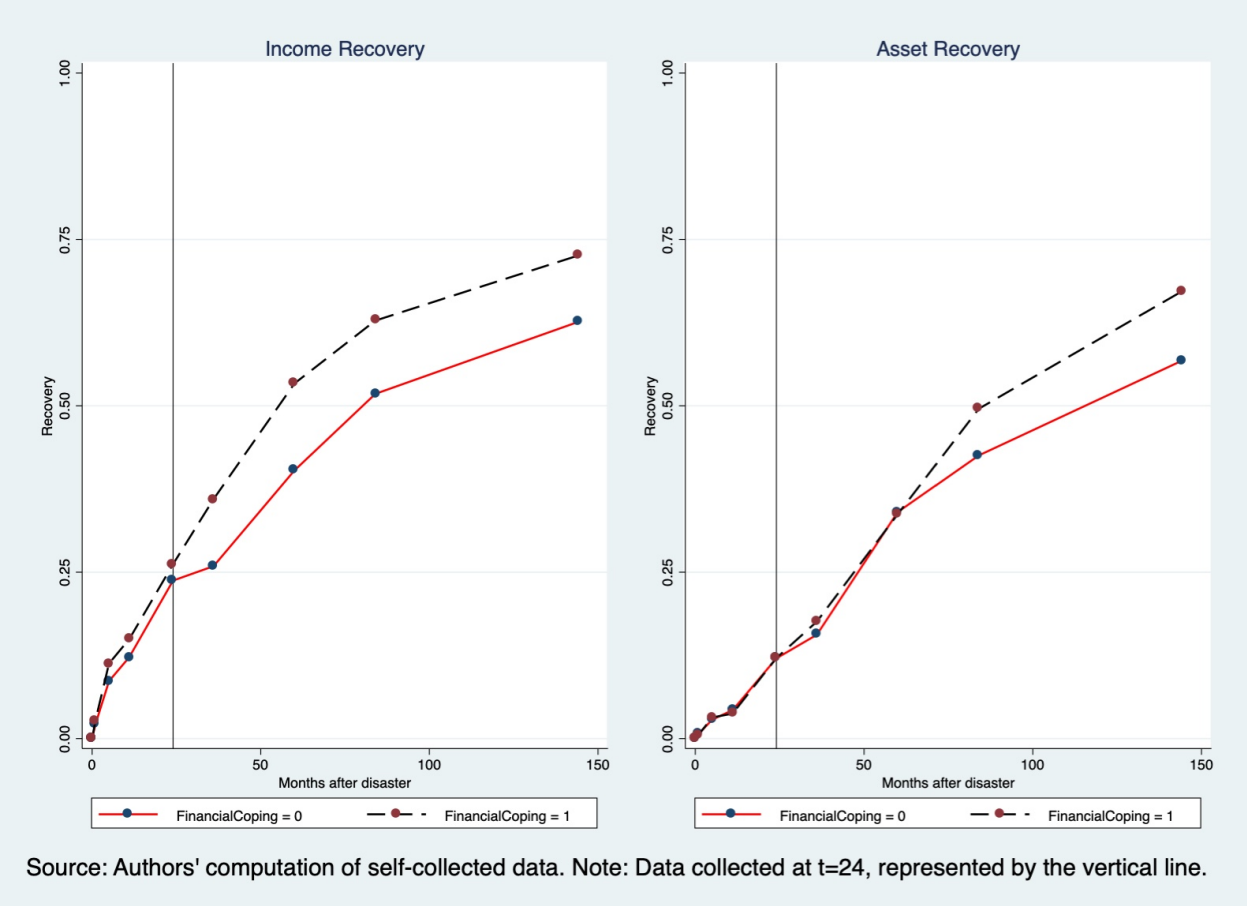
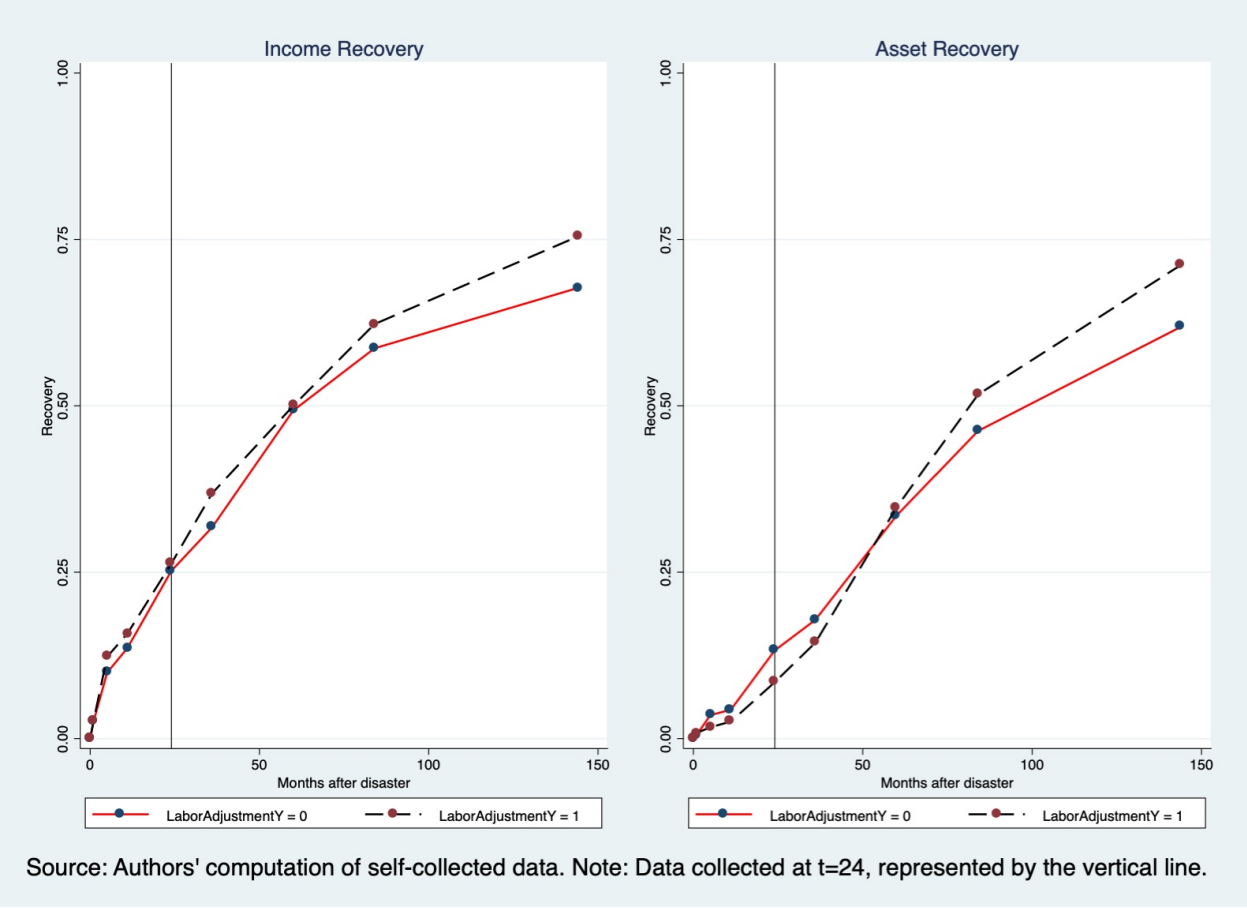
0.25
0.50
0.75
1.00
0
20
40
60
80
Months after disaster

Figure 2



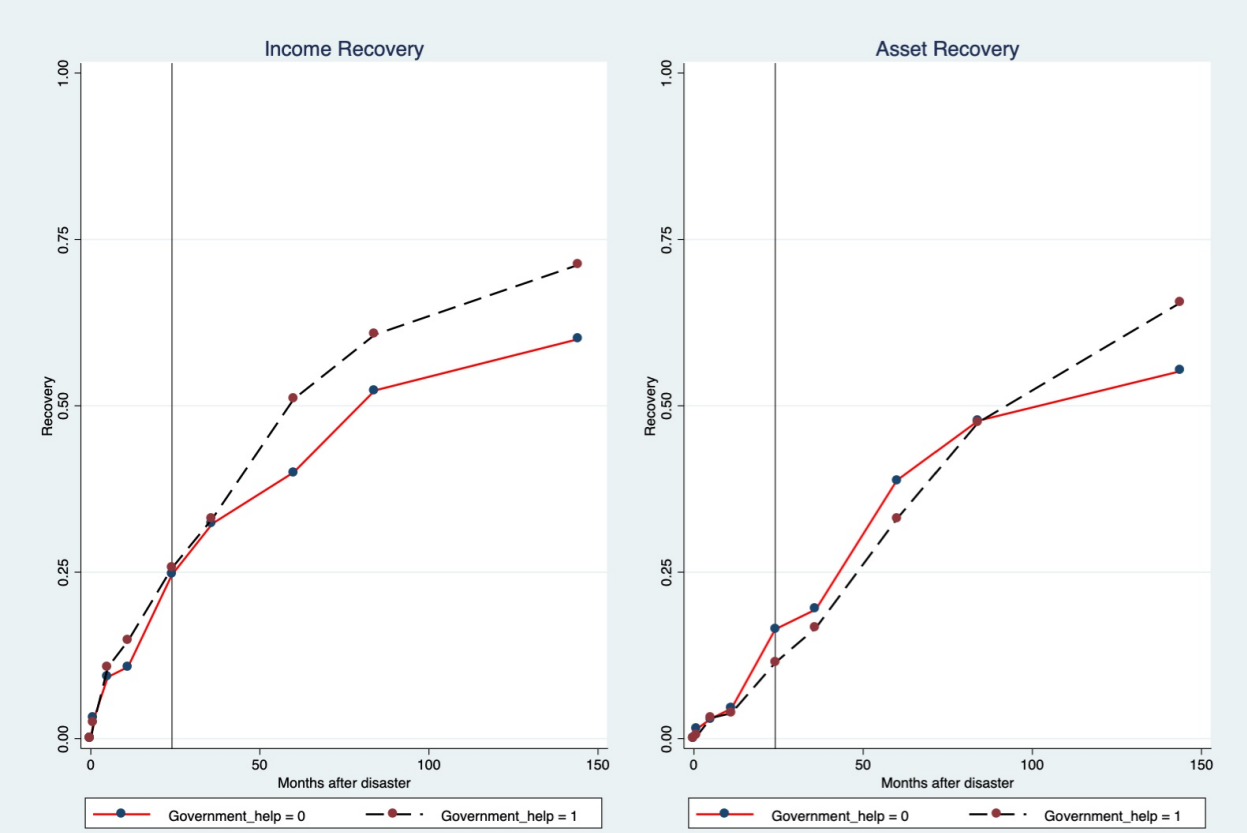
Source: Authors' computation of self-collected data. Note: Data collected at t=24, represented by the vertical line.

Figure 3



Source: Authors' computation of self-collected data. Note: Data collected at t=24, represented by the vertical line.

Figure 4



Source: Authors' computation of self-collected data. Note: Data collected at t=24, represented by the vertical line.

Figure 5