To Move Home or Move On? Investigating the Impact of Recovery Aid on Migration Status after Volcanic Eruptions in Merapi, Indonesia

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Abstract

Disasters are associated strongly with forced migration. Indeed, migration is a standard survival strategy for those facing disruptions of this kind. Such is the case with Mt. Merapi, Indonesia, where a series of eruptions occurred in 2010. Mechanisms related to forced migration in such scenarios are fairly well understood, yet it remains less clear what factors may influence return migration. Herein we seek to better understand the extent to which recovery aid may increase the probability of moving home or moving on. We draw upon data collected from a pilot study in the aftermath of the 2010 eruptions and use multinomial logistic regression models to explore the influence of various forms of aid on migration status. Of the various forms of aid considered, only NGO recovery aid provided to villages was associated with moving home. Alternatively, financial aid provided to households was associated with moving on.

KEYWORDS

Disasters, Internal Displacement, Recovery Aid, and Migration

Introduction

Between October 26th and November 5th, 2010, a series of violent eruptions impacted the region surrounding Mt. Merapi in Central Java, Indonesia. Over time, these eruptions culminated in repeated discharges of ash and lava, as well as the formation of large eruption columns that sent several pyroclastic flows into heavily populated areas located along the slopes of the volcano. The seismic activity was accompanied by heavy rainfall that produced highly destructive lahars. The scale of the 2010 eruption exceeded that of the 1872 eruption, previously the largest eruption on record. Prior to the onset of these eruptions, the Indonesian government raised its alert to its highest level and issued evacuation orders that affected 19,000 people. In total, however, it is estimated that approximately 400,000 people were displaced, 3,300 homes/buildings were destroyed, and 383 people were killed.

Because disasters from natural hazards are associated with high risks to both life and property (Hunter 2005; Cutter et al. 2003), it is not surprising that they are associated strongly with forced migration (Fussell et al. 2010; Hugo 1996; Myers et al. 2008; Sastry and Gregory 2014); either as a temporary evacuation or as a forced migration of longer duration. Indeed, migration, whether temporary or permanent, is a standard survival strategy for those facing disruptions of this kind (Hugo 1996). Such is the case with Mt. Merapi where a major eruption occurs every 2-5 years. However, despite the well-known danger, the area surrounding the mountain remains densely populated. More surprisingly, it is also the site of frequent return migrations as households persist in returning to their original communities once the dangers associated with an eruption have subsided (Hidayati 2011; Rahman et al. 2016). While the mechanisms related to forced migration in such scenarios are fairly well understood (Gray et al. 2014; Hunter 2005), it remains less clear what factors influence whether or not individuals and/or households return to their original place of residence following the disaster (Ruben et al. 2009; Cassarino 2004). Given the increase in incidence of disasters from natural hazards globally, the need to better understand return migration in these contexts is even more acute.

Drawing on survey data collected from a pilot study in the geographic area sur-

rounding Mt. Merapi after the 2010 volcanic eruptions, we explore the extent to which recovery aid was associated with migration status. Specifically, we explore whether the influence of recovery aid varied depending upon whether:

1. Recovery aid was financial vs. other forms of aid
2. Recovery aid was provided to the village vs. the household
3. Recovery aid was provided by government bodies, NGOs, or from the social networks of disaster victims

Through providing empirical evidence addressing these questions, this study contributes to the literature on migration in the context of disasters from natural hazards and contributes to a greater understanding of recovery aid may function as push, pull and intervening obstacles to migration in this context.

Theoretical background

Migration

Migration, broadly defined as a permanent or semi-permanent change of residence (Lee 1966), is a critical driver of demographic change (Findlay and Wahba 2013; Preston et al. 2000). As such, migration has been a core focus in demographic research since Ravenstein proposed his Laws of Migration (Ravenstein 1885). Lee expounded upon and crystallized Ravensteins model; making what is arguably the most significant contribution to the theoretical understanding of migration during the 20th century (Lee 1966). Central to Lee's theory of migration is the conceptualization of push factors associated with locations of origin, and pull factors associated with locations of destination. Mediating these push and pull factors are intervening obstacles that prevent or delay migration. Recent theories on general migration at the individual level are often couched within a framework of rational choice that reflects the push/pull factors individuals take into account, as well as intervening obstacles (DaVanzo 1980; De Jong and Fawcett 1981; Hunter 2005; Lee 1966; Massey et al. 1993). Prominent among such frameworks is the focus on economic incentives, in which a dearth of opportunities at an individual's place of origin (i.e., push factors) are juxtaposed with ample op-

portunities in potential destinations (i.e., pull factors). Migration studies specific to Indonesia echo this trend, and have found that economic factors were foremost in predicting migration during the 20th century (Elmhirst 2012; Van Lottum and Marks 2012). Similar themes are found within frameworks for general return migration along with some noteworthy adjustments.

Return migration

Several theoretical frameworks have come to inform research on return migration (Cassarino 2004). In the first two, the *Neoclassical Economics* and the *New Economics of Labor Migration* (NELM), motivations for return migration are strongly influenced by financial or economic factors. *Neoclassical Economics* views migrants as individuals seeking to maximize their earnings as well as the duration of their migration for the purpose of achieving permanent settlement, thus return migration is viewed as failure. In contrast, NELM views return migration as the successful realization of goals set forth in a 'calculated strategy' defined by the migrant's household (Cassarino 2004; Stark 1991, 1996; Taylor 1996). Within NELM, the realization of these goals constitutes an important explanatory factor of return migration, attachment to one's home country or community constitutes another.

In contrast to the first two frameworks, which detach the migration decisions of returnees from the context of their geographic, social and political environment, the structural approach asserts that return migration cannot be properly understood with sole reference to the experiences of individual migrants, but requires contextual understanding of social and institutional factors (Cassarino 2004; Gardner 1981). As such, return migration is as much a question of context (e.g., local power relations, traditions and values) as it is of individual or household aspirations. Within the structural approach, two important factors affecting return migration are space and time (Cassarino 2004; Dumon 1986; Dustmann 2003; King 2015); i.e., resettlement and readjustment are processes that require time and the places that returnees ultimately settle strongly influences processes of reintegration. Given the importance of space and time, two related contextual factors that may impact decisions to migrate are community or place attachment and length of residence. Community attachment is

an indicator of how connected an individual feels to his/her community (Brown et al. 2000, 430). Community attachment may exhibit a pulling influence on individuals or households who choose to forgo economic opportunities available in destination locations if they feel a strong attachment to their original community. Similarly, length of residence in a community may affect migration decisions, as it is one of the most important factors associated with community attachment (Kasarda and Janowitz 1974). Longer durations of residence in a community should be associated with greater levels of attachment to that community and a reduced likelihood of migration.

Beyond individual and structural/contextual frameworks, researchers have explored the influence of social networks on return migration. Within this framework returnees are sources of tangible and intangible resources who maintain strong linkages with their former places of settlement. The resources they obtain affect those within their network, but also their ability to return. Overall success relies upon the formation and maintenance of long-standing interpersonal relationships, as well as the regular exchange of mutually valuable items between actors. This framework posits that returnees should be seen as social actors who seek out and maintain ways to ensure return to their communities and homelands (Cassarino 2004).

Disasters from natural hazards and migration

While general migration theories provide a helpful starting point, theories concerning migration in the context of disasters from natural hazards require further refinement. While migrants in these contexts are still seeking to maximize life outcomes, the primary goal in these situations is often the maintenance of life itself. As such, the factors and mechanism at play deserve further specification.

Understanding of migration decisions in the wake of disasters necessitates the consideration of broader macro-level context, particularly the significance of ecological pushes that encourage people to migrate (Belcher and Bates 1983; Gardner 1981; Hugo 1996; Hunter 2005; Myers et al. 2008; Petersen 1958, 1975). Hugo addressed these ideas and maintained that in the context of disasters, migration is probably viewed best on a continuum that ranges from totally voluntary migration–in which choice is the overwhelmingly decisive element that encourages people to move–to com-

pletely forced migration, where the migrants are faced with death if they remain in their present place of residence (Hugo 1996). The extent to which a migration is more or less forced depends upon the severity of the hazard, perceptions of risk tied to the hazard (Nawrotzki et al. 2014), and the response of macro-level actors, such as government and non-governmental organizations (NGOs) (Hugo 1996; Hunter 2005; Rogers 1992). Given that forced migration is by definition less voluntary, it is also often less selective compared to general migration (Gray et al. 2014). Accordingly, some indicators that weigh heavily in general migration theory (e.g., gender and age) are not always significant and other indicators (e.g., socioeconomic status) may operate in reverse (Gray et al. 2014). This is particularly the case when the severity of the disaster is such that entire populations are forced to migrate. However, the more voluntary the migration, the more likely it will reflect the characteristics of general migrations (Hugo 1996; Hunter 2005).

Return migration in the context of a previous forced migration requires better understanding (Ruben et al. 2009). Consistent with general migration theory, prior studies have found that economic incentives often are associated with the likelihood of return migration (Reagan and Olsen 2000). Beyond economic incentives, a systematic review (Bryner et al. 2017) identified the habitability of homes, access to affordable housing, financial burdens, the extent of restoration of public services and facilities, and a sense of place and identity as major factors influencing return migration in the aftermath of a disaster. Fear of future disasters, stress associated with recovery, and loss of employment were also influential (Bryner et al. 2017). Other research has shown that education, employment, and other indicators of socioeconomic status may influence return migration after a natural disaster (Karimi 2017). While return migrants face multiple intervening obstacles to reestablishing themselves successfully in their old communities (Ruben et al. 2009), including the continued perception of risk associated with the previous natural disaster (Nawrotzki et al. 2014), recovery aid in the aftermath of the disaster may help mitigate various obstacles returning home; e.g., helping to improve the habitability of damaged homes, restoring public services and facilities, or to relieve stress associated with the disaster.

Recovery aid and migration status

In the context of disasters, governments and NGOs have the potential to act as intervening agents that either prevent or facilitate migration, both by creating policies concerning return migration (Rogers 1992), and by the extent to which they offer aid to help return migrants reestablish themselves (Ruben et al. 2009). Herein we opt to focus on the effects of recovery aid.

Federal and international aid can be an incentive for households to remain in their localities rather than migrate away from disaster-prone areas (Boustan et al. 2012). After a tornado struck North-Central Bangladesh in 1996, decisions to remain in original communities were strongly affected by recovery aid resulting in minimal outmigration (Paul 1998). Likewise, after another tornado in 2004, the vast majority of people affected by the disaster still chose to remain in the area (Paul 2005). For the most part, recovery aid from government agencies and NGOs in these instances was distributed to households in an equitable manner and surpassed the cost of the damages suffered, thus encouraging those affected by the tornadoes to remain in their communities (Paul 2005). Similarly, aid packages were offered as incentives to households and businesses in an effort to curb outmigration after a series of earthquakes hit Christchurch, New Zealand between 2010-2011. The vast majority of businesses and organizations chose to remain in Christchurch rather than relocate (Stevenson et al. 2011, 2012). These examples indicate that post-disaster aid can create incentives for people to stay in their original communities.

Alternatively, recovery aid has also succeeded as a tool for encouraging outmigration from hazardous areas. After massive flooding hit Malaysia, relocation plans were designed to encourage people to move out of flood-prone areas (Weng Chan 1995). Because of the high cost of migration, rural peasants were unlikely to migrate if aid was not guaranteed. If aid was guaranteed in the form of a job, home, and/or lands outside of their communities and outside the disaster zone, the people from affected regions were highly likely to migrate (Weng Chan 1995). However, because a large number of people were effected by floods, the government was unable to supply enough aid to encourage everyone to leave the hazardous peninsula, resulting in minimal migration (Weng Chan 1995). Additionally, a study done on settlement abandonment in Mont-

serrat after a volcanic eruption examined migration and noted that rebuilding and relocation would not have been possible without financial aid from the UK government (McLeman 2011). For half of the island population, the aid offered by the UK encouraged them to relocate off the island (Rozdilsky 2001). Of those individuals that chose to migrate, approximately half relocated to other Caribbean islands and half resettled to Great Britain (Rozdilsky 2001). Thus, aid packages have in some instances been used successfully to encourage people to leave their residence.

Recovery aid may encourage outmigration when it is slow to reach geographically isolated locations. In Kenya and Somalia, rural and pastoral victims of drought migrated towards towns and city centers because these locations offered food aid and a chance to diversify their livelihood, protecting from future disasters (Little et al. 2001). Along the same lines, when post-disaster recovery is lacking nationwide, people tend to migrate towards cities. In Ethiopia during times of food shortages, households did not have access to needed aid (Ezra and Kiros 2001). Family members choose to migrate to cities and towns where income was higher and job opportunities were more abundant (Ezra and Kiros 2001). Additionally, after the earthquake-avalanche in 1970 in Peru, rather than provide loans to rebuild homes, the government chose to build temporary houses and distribute them on a first come first serve basis (Oliver-Smith 1990). The temporary housing, as well as the higher wages promised by the reconstruction committee, attracted increased rural migration. Rural peasant migration continued to city areas where aid was provided even after permanent housing was established and rural non-homeowners were given lowest priority (first, second, and third priority going to landowners and renters (Oliver-Smith 1990).

The findings from these studies suggest that recovery aid can successfully function as a tool for influencing migration decisions, both for increasing probability of return migration as well as for outmigration, depending on how it is organized and distributed.

Geographic and ethnic context

Indonesia is a vast archipelago that includes approximately 17,500 islands. When both land and sea are included, Indonesia ranks geographically as the 7th largest coun-

try, covering 1,919,440 square kilometers (CIA 2016). It is also home to approximately 252,000,000 people, making it the 4th largest country in population. Indonesia is also a nation of substantial linguistic and ethnic diversity, with over 700 spoken languages and 15 ethnic groups that comprise 85% of the population. The largest of the major ethnic groups are the Javanese, who make up roughly 40% of the total population (CIA 2016).

Mt. Merapi is located in the central region of Java, Indonesia, the most highly populated island on the planet, with an average population density of 1000 persons per square kilometer. Of interest to this investigation, the population density within a 15 kilometer radius of Mt. Merapi ranges from 0 to 5000 per square kilometer. Within this geographic area, roughly 98% of the population are ethnic Javanese (Suryadinata et al. 2003). A common Javanese proverb, 'Sedumuk batuk senyari bumi', is interpreted to mean that *'dignity and land are things to strive for'*. The proverb highlights the attachment that Javanese people have to their land and community. This attachment has been highlighted as part of the explanation for some residents choosing to return to their original villages despite the well known risks (Hidayati 2011; Rahman et al. 2016). However, in the aftermath of the 2010 eruptions, the Indonesian disaster management agency "Badan Nasional Penanggulangan Bencana" (BNPB), in collaboration with other government agencies, endeavored to reorganize residential areas for the purpose of hazard mitigation. For this purpose, a risk analysis was carried out identifying the southern slopes of Merapi as those at highest risk (Hidayati 2011). In line with these findings, the government has sought to encourage villagers living along Merapi's southern slopes to relocate to less hazardous areas.

Research expectations

Drawing upon the extant literature, we anticipate that the influence of outside interventions by government or NGOs, or an individual or household's social network, will vary by the type of aid. Specifically, we anticipate that recovery aid provided to villages by either NGOs or government agencies to help rebuild will create incentives for return migration. Likewise, we anticipate that recovery aid provided in kind (e.g.,

food or health aid), may help remove intervening barriers to return migration and thereby increase likelihood of return among a population with a high propensity to return. In contrast, we anticipate that financial aid may function as a facilitator of either returning to one's prior village or relocating to a new, safer village as opposed to remaining displaced.

Data and methods

To address our research questions, we drew on data from the "Community Recovery after a Natural Disaster: A Survey of Communities Affected by Mt. Merapi Eruptions" study. The survey questionnaire used in the study was developed in an iterative process by a research team including members from Indonesia and the United States. After initial development in English, the questionnaire was translated into Bahasa Indonesia by a translation team made up of research team members who were native speakers of either Bahasa Indonesia or English, but who were also fluent in their non-native language of either Bahasa Indonesia or English. The translation process included standard translation/back-translation steps in an effort to increase the accuracy and cultural appropriateness of the questionnaire. The data were collected by student research assistants and faculty at the Institute of Community Development Research Center, Yogyakarta, Indonesia. All interactions between the researchers and respondents were carried out in Bahasa Indonesia, and data were then translated into English and entered into a database for further statistical analysis.

The study was conducted 16 months after the 2010 eruptions. It was organized as a pilot study to document the experiences of victims of the disaster; including their experiences related to disaster preparedness, mitigation, and recovery, as well as their overall experience of the emergency. This has important implications for the overall power, or limitations, of the data collected to investigate migration in response to the eruptions.

Sampling procedures

Respondent sampling was conducted with two specific aims in mind. First, to create a sample that captured varying levels of destruction experienced by victims of the eruption. Second, to create a sample that included respondents who were still living in a disaster shelter, respondents who had returned to their previous community, and respondents who had moved on to a new community.

To generate a sample representative of varying levels of destruction, the geographic sampling area was oriented to the radius/peak of Mt. Merapi and then subsequently divided into different zones that ranged from the most to the least affected. The zone that was most negatively affected by the eruption was referred to as Zone III or Rawan Bencana III. In this area, the eruption of Merapi had disastrous effect on the environment and infrastructure, and was associated with a significant loss of life for a variety of plants and animals. Zone II was affected less than was Zone III, and Zone I was affected the least. In total, we selected four districts: Turi, Pakem, Cangkringan, and Ngemplak.

Selection of the sampling area was organized so that a variety of locations were included, ranging from those damaged most severely to those damaged the least. The districts of Turi, Pakem, and Cangkringan are located close to the summit of Mount Merapi (Zone III). Conversely, Ngemplak is located to the south of Cangkringan District in the eastern area of Sleman Regency. In Ngemplak District, most victims were among those who lived near a river. The extent of destruction in this district varied: some people remained unaffected, some homes were damaged minimally, and some were destroyed completely. In some cases, the extent of the devastation was such that entire villages vanished, leaving only what looked like a field of sand where they once stood.

Several criteria were used to choose the respondent village and shelter communities. First, a district was divided along its radius from north to south, and from east to west. People who were closest to the peak of Merapi in Turi District lived in Girikerto and Wonokerto villages. In Pakem District, the people closest to the volcano lived in Turgo Village. In Cangkringan, Kinahrejo was the northernmost village with closest proximity to the volcano. Finally, in Ngemplak District, Sindumartani was the village

damaged most severely. The remainder of the villages selected experienced damage that ranged from moderate to slight.

Respondent selection

After establishing the sampling procedure, individual respondents were selected to obtain a sample of those who still lived in a shelter, those who had returned to their previous communities, and those who had moved away. The method for respondent selection was similar to the selection process used to identify villages and shelters within the districts. Residences were selected starting from the northernmost part of a village or shelter community and selection then moved from east to west and gradually south. Within this process, households were chosen randomly. The selection was conducted until there were 40 respondents from one village, with one respondent per household (respondents were individuals that identified as head of household). By drawing respondents from 10 different villages or shelter communities, we obtained a total respondent sample of 400.

The sample procedures and protocol for respondent selection were established with the goal of creating a sample representative of the varying levels of destruction that respondents experienced from the eruption. However, as a post-disaster study we are unable to directly assess the extent to which our sample is representative of the pre-disaster population. Some of the persons displaced by the eruption may have migrated beyond the geographic scope of our study. While this is a concern, qualitative data gathered through interviews and focus groups suggest that the vast majority of displaced persons remained within the geographic region surrounding Mr. Merapi, a pattern consistent with research carried out by the Indonesian disaster management agency BNPB (Hidayati 2011) and documented in related studies (Rahman et al. 2016). In addition, comparing demographic characteristics of our sample with 2010 census data for Indonesia (Statistik 2010) suggests that the distribution of respondents within our sample is comparable to that in the Special Region of Yogyakarta and similar to the general population of Indonesia (see Appendix A). For example, our study sample almost matches the population distribution of DI Yogyakarta in terms of religion and is comparable to that for Indonesia overall. While our study sample

had a somewhat higher distribution of educational attainment in comparison to the population of DI Yogyakarta, this differences is likely attributable to the age distributions in our sample as educational attainment in DI Yogyakarta decreases with age, so a younger sample in our data would result in somewhat elevated percentages for education attainment.

Measures

The dependent variable in our analysis captured *Migration Status* in terms of whether or not a respondent and/or his/her family were displaced, in transition, had moved on, or had moved home at the time that the surveys were collected (100% of our sample was originally displaced due to an evacuation order). *Migration Status* was organized as a categorical measure with having 'moved home' set as the reference category. We set "moved home" as the reference category because we wanted to analyze what types of recovery aid were associated with having moved home versus remaining displaced, but also to analyze what types of recovery aid were associated with having moved home versus having moved on. Additional analyses, conducted with "displaced" set as the comparison group, yielded similar results.

The independent variables of interest were divided into three sets. The first set included various types of recovery aid. Specifically, dichotomous variables were used to assess the impact of *Government Recovery Aid* or *NGO Recovery Aid* (1 = Received) provided to the respondent's original village. *Financial Recovery Aid*, *Food Recovery Aid*, and *Health Recovery Aid*, coded as dichotomous variables (1 = Received), were used to assess the impact of recovery aid provided to the respondent's household. Finally, *Remittances*, coded as a dichotomous variable (1 = Received), was used to assess the impact of recovery aid provided to the respondent's household through their social network.

A second set included measures for demographic characteristics and place attachment, which often influence migration decisions in more general settings (Curran et al. 2006; Elmhirst 2007; Gray et al. 2014; Kelly 2011). We measured *Age* as a categorical variable with six age groups ranging from 1 = 18 to 30 years old to 6 = 70+ years old (the first age group, 18 to 30, was set as the reference category). *Sex* was included as

a dichotomous variable with 1 = Male. *Married* was also included as a dichotomous variable with 1 = Married. *Education* was measured as a categorical variable with 1 = Primary School or Less, 2 = Junior High School, and 3 = Senior High School and Beyond (the first education group, Primary School or Less, was set as the reference category). *Income* was measured as a categorical variable with 1 = 0 to 500,000 Rupiah; 2 = 50,001 to 800,000 Rupiah; and 3 = 800,001 to 1,000,000 Rupiah; and 4 = 1,000,000 Rupiah and Beyond (the first income group, 0 to 500,000 Rupiah, was set as the reference category). Finally, as a proxy for community attachment, *Residence Duration* was calculated by dividing the total number of years lived in the previous community by the respondent's age and then dichotomizing the results such that 1 = whole life, 0 = other. We used this measure as prior research has indicated it is a strong predictor of community attachment (Kasarda and Janowitz 1974).

The third set of independent variables included measures of the level of destruction experienced as a result of the volcano, which have been found to influence migration decisions in the context of disasters (Bryner et al. 2017; Hugo 1996; Karimi 2017; Nawrotzki et al. 2014). *Residence Damaged or Destroyed* was measured as a dichotomous variable with 1 = Yes. *Environmental Hazards* measured the number of various environmental hazards the respondent's household had experienced in the past year, coded as a count variable ranging from one to three plus. The variable *Perceived Destruction* measured a respondent's perception of the total damage that they experienced because of the volcanic eruption, coded as a categorical variable with 1 = Low (reference group), 2 = Medium, and 3 = High. *Fears Nature's Wrath* was coded as a dichotomous variable (1 = Strongly Fears Nature's Wrath).

Analytic strategy

To address our research questions, we evaluated associations between respondents' migration status and various forms of recovery aid using multinomial logistic regression models. Given that 100% of the sample was displaced and subsequently received aid, these analyses were used in an attempt to identify the treatment effect of the various forms of recovery aid. Separate models were estimated for each type of recovery aid

to avoid problems with possible collinearity, with two separate models estimated for each type of recovery aid:

- Model 1 adjusts for factors typically associated with migration in general settings
- Model 2 adjusts for factors associated with migration in the context of disasters, in addition to the factors include in Model 1

Estimation of regression coefficients, which were converted to odds ratios, was treated as an intermediate analytic step. Once estimated, the coefficients were used to estimate predicted probabilities of migration status. Associations between predicted probabilities of migration status and various forms of recovery aid, as well as 95% confidence intervals, were organized into analytic data visualizations in the R statistical programming environment (R Core Team 2013). These visualizations were organized such that the association between each migration status and recovery aid was contextualized by respondent's age.

Results

The majority of respondents in our study had either already moved home (48 %) or were still displaced (41 %) at the time of data collection (see Table 1 for descriptive statistics). In contrast, roughly 6 % of respondents were still in transition and another roughly 6 % had moved on or relocated to a new area. This distribution is consistent with the aforementioned tendency for individuals/households living near Mt. Merapi to return to their original communities after eruptions, despite awareness that Merapi is an active volcano that erupts regularly (Hidayati 2011). Fifty-four % of respondents reported that NGO recovery aid was distributed to their original village, while roughly seventy-two % percent reported that Government recovery aid was distributed to their original village in the aftermath of the eruptions. At the household level, 46% reported receiving financial recovery aid, 66% reported receiving health recovery aid, and 64% reported receiving food recovery aid. Only 54 respondents (approximately 14%) reported receiving financial remittances from their social networks. Within the study sample, 205 of the 398 respondents reported some or complete damage/destruction

of their original homes/dwellings. 272 respondents reported that they strongly feared the wrath of nature.

[Table 1 about here]

NGO recovery aid

Results for the analyses evaluating the relationship between *NGO Recovery Aid* and *Migration Status* are presented as Odds Ratios (OR) in Table 2. In addition, predicted probabilities of *Migration Status* are presented in Figures 1 and 2, which visualize the associations presented in Model 1 and Model 2 from Table 2 respectively. A similar pattern of tables and figures are used for each subsequent type of recovery aid.

[Table 2 about here]

After adjusting for factors typically associated with migration under general circumstances, respondents who formerly lived in villages that received *NGO Recovery Aid* in the aftermath of the disaster were less likely to be *In Transition* (OR = 0.80), to have *Moved On* (OR = 0.72), or to be *Displaced* (OR = 0.60) compared to having *Moved Home* (see Model 1 in Table 2). Perhaps somewhat more intuitive, the predicted probabilities visualized in Figure 1 present a clear bifurcation between respondents whose villages had received *NGO Recovery Aid* and those whose villages had not with regards to having *Moved Home* and being *Displaced*, with *NGO Recovery Aid* associated with higher probability of having *Moved Home*. Predicted probabilities for *In Transition* and *Moved Home* are indistinguishable. Similar patterns are presented in Figure 2, although the coefficients used to estimate these predicted probabilities were not statistically significant. These are the only results that consistently suggest a positive association between a type of recovery aid received and respondents returning to their original community.

[Figures 1 and 2 about here]

Government recovery aid

Respondents who formerly lived in villages that received *Government Recovery Aid* in the aftermath of the disaster were less likely to be *In Transition* (OR = 0.38) or *Displaced* (OR = 0.79), but more likely to have *Moved On* (OR = 1.14), compared to having *Moved Home* (see Model 1 in Table 3). The visualized predicted probabilities in Figure 3 present distinguishable bifurcations between respondents whose villages had received *Government Recovery Aid* and those whose villages had not with regards to having *Moved Home*, and less distinguishable bifurcations with regards to being *In Transition* or *Displaced*, with *Government Recovery Aid* associated with higher probability of having *Moved Home*–a pattern consistent with *NGO Recovery Aid*.

[Table 3 about here]

However, these associations change after adjusting for factors associated with migration in the context of disasters (see Model 2 in Table 3). After adjusting for these additional factors, respondents who formerly lived in villages that received *Government Recovery Aid* in the aftermath of the disaster were more likely to have been *Displaced* (OR = 2.54), compared to having *Moved Home*. These changes in the associations between *Government Recovery Aid* and migration status are likewise reflected in the predicted probabilities presented in Figure 4, with *Government Recovery Aid* now associated with higher probability of being *Displaced*.

[Figures 3 and 4 about here]

Financial recovery aid

Respondents whose household received *Financial Recovery Aid* were less likely to be *In Transition* (OR = 0.94), but more likely to have *Moved On* (OR = 8.99) or be *Displaced* (OR = 6.87), compared to having *Moved Home*, after adjusting for factors typically associated with migration under general circumstances (see Model 1 in Table 4). The patterns of the predicted probabilities in Figure 5 include substantial bifurcations (between a 25 to 50 % difference) between respondents whose household had received *Financial Recovery Aid* and those who had not with regards

to having *Moved Home* and being *Displaced*, with *Financial Recovery Aid* associated with higher probability of being *Displaced*. However, the predicted probabilities also indicate that *Financial Recovery Aid* is associated with higher probability of having *Moved On* among younger adults and the elderly.

[Table 4 about here]

Adjusting for factors associated with migration in the context of disasters results in a weaker association for being *Displaced* (OR = 5.09), but a stronger association for having *Moved On* (OR = 11.62) (see Model 2 in Table 4). These changes in the associations between *Financial Recovery Aid* and migration status result in decreased bifurcation in the predicted probabilities presented in Figure 6 for having *Moved Home* and being *Displaced*, but with an increase in the bifurcation for having *Moved On* (roughly a 25 % difference for the youngest and oldest age categories)–these are the strongest associations for increased probability of moving on to reside in a new location identified in the study.

[Figures 5 and 6 about here]

Health recovery aid

Respondents whose household received *Health Recovery Aid* were more likely likely to be *In Transition* (OR = 1.17), to have *Moved On* (OR = 2.29), or be *Displaced* (OR = 4.27) compared to having *Moved Home* after adjusting for factors typically associated with migration under general circumstances (see Model 1 in Table 5). Here again, the predicted probabilities in Figure 7 include substantial bifurcations (between a 25 to 50 % difference) between respondents whose household had received *Health Recovery Aid* and those who had not with regards to having *Moved Home* and being *Displaced*, with *Health Recovery Aid* associated with higher probability of being *Displaced*.

[Table 5 about here]

Adjusting for factors associated with migration in the context of disasters results in a slightly weaker association for being *Displaced* (OR = 4.16), but a slightly stronger as-

sociation for having *Moved On* (OR = 2.45) (see Model 2 in Table 5). These changes in the associations between *Health Recovery Aid* and migration status result in decreased bifurcation in the predicted probabilities presented in Figure 8 for having *Moved Home* and being *Displaced*.

[Figures 7 and 8 about here]

Food recovery aid

After adjusting for factors typically associated with migration under general circumstances, respondents whose household received *Food Recovery Aid* were less likely to be *In Transition* (OR = 0.70), but more likely to have *Moved On* (OR = 1.33) or be *Displaced* (OR = 1.55), compared to having *Moved Home* (see Model 1 in Table 6). However, these results were not statistically significant. Adjusting for factors associated with migration in the context of disasters did not substantially change the results.

[Table 6 about here]

In accordance with the associations presented in Table 6, the visualized predicted probabilities in Figures 9 and 10 suggest minimal difference between respondents whose household had received *Food Recovery Aid* and those who had not.

[Figures 9 and 10 about here]

Remittances

Respondents whose household received *Remittances* were less likely to be *In Transition* (OR = 0.43) or be *Displaced* (OR = 0.66), but more likely to have *Moved On* (OR = 1.33), compared to having *Moved Home*, after adjusting for factors typically associated with migration under general circumstances (see Model 1 in Table 7). However, these results were not statistically significant. The patterns of the predicted probabilities in Figure 11 include small bifurcations (between a 5 to 10 % difference) between respondents whose household had received *Remittances* and those who had not with regards to having *Moved Home* and being *Displaced*, with *Remittances* associated with higher probability of being *Moved Home*.

[Table 7 about here]

Adjusting for factors associated with migration in the context of disasters results in a weaker association for being *Displaced* (OR = 0.87), but a stronger association for having *Moved On* (OR = 1.74) (see Model 2 in Table 7). These changes in the associations between *Remittances* and migration status result in decreased bifurcation in the predicted probabilities presented in Figure 12 for having *Moved Home* and being *Displaced*, but with a small increase in the bifurcation for having *Moved On* (resulting in an approximate difference of 10 % for the youngest age categories).

[Figures 11 and 12 about here]

Discussion

We set out to assess the extent to which external recovery aid in the aftermath of a disaster may influence *Migration Status*. The majority of the types of aid considered were associated with displaced households. Given that 100% of the sample was originally displaced, we interpret these results as suggesting that while these forms of aid may have helped to address some of the needs of displaced persons or households in the aftermath of the eruptions, they were not associated with helping them to either move home or move on (i.e., we see no evidence of a treatment effect).

Alternatively, NGO recovery aid provided to villages in the aftermath of the eruptions and related evacuations was consistently associated with displaced households returning to their original villages. These results are suggestive of a possible treatment effect in which recovery aid geared towards rebuilding villages creates incentives for return migration. In addition to corroborating these results, future research should seek to better understand the underlying factors driving this association in an effort to identify more specifically how *NGO Recovery Aid* was different from the other types of aid evaluated–particularly *Government Recovery Aid*, which had mixed effects on migration status.

Apart from the association between *NGO Recovery Aid* and *Migration Status*, the results indicate a trend with regards to financial resources, which were consistently

associated with households moving on to relocate in new areas. *Financial Recovery Aid* provided to households was strongly associated with having moved on, with an increase in predicted probability of nearly 25% for younger adults and the elderly. Similarly, results for *Remittances* were consistent with these findings, although their impact was less substantial and not statistically significant. Likewise, although not the focus of this study, the analyses consistently demonstrate that households with higher levels of income, regardless of other forms of recovery aid received, were more likely to have moved on, a finding which corroborates the associations between *Financial Recovery Aid* and *Migration Status*. Given the interest to facilitate household relocation to safer areas (Hidayati 2011; Rahman et al. 2016), these results suggest that the provision of financial resources is likely the best form of recovery aid for achieving this objective.

We acknowledge the need for caution in interpreting our results–they are associations and our ability to make causal inference is limited. Our interpretation that these associations suggest possible treatment effects is based primarily upon the temporal sequence of events. However, these limitations acknowledged, we anticipate that these preliminary findings have policy implications for government and non-government organizations seeking to influence how populations resettle in the aftermath of a disaster–especially for organizations operating in the Merapi area. Furthermore, these preliminary findings can help guide future research; particularly research focused on the reoccurring impact of eruptions from Mt. Merapi.

While we believe this study has policy implications and also contributes to the literature on migration in the aftermath of a disaster, we recognize that it is not without limitation. The data used were part of a pilot study organized to document in detail the experiences of victims of the disaster. This affects our ability to leverage these data for statistical analyses investigating migration status as this was not the main purpose of the data. In addition, as a pilot study, only a relatively small sample of data was collected. This limits the statistical power of our analyses such that some indicators may have had stronger statistical significance if the study size was larger and/or more nuanced analyses could have been conducted.

There is also the potential for bias within our data, as discussed in detail in the methods section. Sample bias may exist as our sample only included the geographic

region surrounding Mt. Merapi. It is possible that some of the persons displaced by the eruption migrated beyond the geographic scope of our study. It is unfortunate that for individuals or households who may have moved further away, we are unable to assess whether or not they were more likely to have experienced more severe consequences or the disaster compared to those who remained in the same geographic region or if they were they more likely to have had the means to resettle further from their original home. It is difficult to directly assess how this potential bias may affect our results, but given our theoretical framework we anticipate that their absence from the study results in more conservative estimates. It is possible that there is also recall bias within our data due to the timing of data collection. However, given that data collection for all respondents occurred in the same time period, we anticipate that any recall bias within our data is non-differential.

Finally, as with the majority of disasters from natural hazards, these findings come from a specific event, occurring at a specific time and in a specific location. This is important given that the destruction resulting from Mt. Merapi's eruption only became a natural disaster through interaction with local social systems. As Perry states, "It is not the hurricane wind or storm surge that makes the disaster; these are the sources of the damage. The disaster is the impact on individual coping patterns and the inputs and outputs of social systems" (Perry 2007, 12). In as much as a disaster is a social phenomenon (Perry 2007; Quarantelli and Dynes 1977) that is inherently local, it is difficult to gauge the extent to which our findings are generalizable beyond the context of Java, Indonesia. At a minimum, these findings could inform other research studies through incorporation into a future systematic review or meta analysis of indicators of return migration in the aftermath of disasters from natural hazards.

Despite these limitations, Despite these limitations, we have endeavored to provide to provide meaningful insights to potential associations between various types of recovery aid and migration status in the aftermath of a disaster. Moreover, as we move beyond this pilot study to continue conducting research in the region, these results, as well as lessons learned while conducting this pilot study, will inform our efforts to better understand the social ramifications of Mt. Merapi's frequent eruptions–the most recent of which occurred earlier this year (Press 2018).

This study evaluated multiple types of recovery aid in order to identify which types may play a role in influencing migration decisions in the aftermath of a disaster. While return migration in these circumstances may constitute an opportunity for migrants to reclaim what they lost and begin anew, classic studies on the effects of disasters from natural hazards suggest that the process of starting over is difficult and life is never truly the same (Erikson 1978; Ruben et al. 2009). The trip home is but the first step in regaining what was lost, and therefore, return may not be the best choice. Moreover, there is apparent interest in the current context to help the most vulnerable relocate to safer locations. Given these circumstances, future research should evaluate the effects of return migration on life outcomes, such as health and quality of life. While buildings can be rebuilt, the same is not always true of the past, and perhaps for some it would indeed be better to move on rather than move back–especially in a world where disasters from natural hazards are an ever more frequent reality.

References

Belcher, J. C. and Bates, F. L. (1983). Aftermath of natural disasters: coping through residential mobility. *Disasters*, 7(2):118–128.

Boustan, L. P., Kahn, M. E., and Rhode, P. W. (2012). Moving to higher ground: Migration response to natural disasters in the early twentieth century. *American Economic Review*, 102(3):238–44.

Brown, R. B., Xu, X., Barfield, M. A., and King, B. G. (2000). Community experience and the conceptual distinctness of rural community attachment and satisfaction - a measurement model. *Research in Community Sociology*, 10:427–46.

Bryner, N. S., Garcia-Lozano, M., and Bruch, C. (2017). Washed out: policy and practical considerations affecting return after hurricane katrina and superstorm sandy. *Journal of Asian Development*, 3(1):73–93.

Cassarino, J.-P. (2004). Theorising return migration: the conceptual approach to return migrants revisited. *International Journal on Multicultural Societies*, 6(2):253–279.

CIA (2016). Indonesia. In *The World Fact Book*. Central Intelligence Agency.

Curran, S. R., Shafer, S., Donato, K. M., and Garip, F. (2006). Mapping gender and migration in sociological scholarship: is it segregation or integration? *International Migration Review*, 40(1):199–223.

Cutter, S. L., Boruff, B. J., and Shirley, W. L. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly*, 84(2):242–261.

DaVanzo, J. (1980). *Micro economic approaches to studying migration decisions*. Rand, New York, NY.

De Jong, G. F. and Fawcett, J. (1981). Multidisciplinary frameworks and models of migration decision making. In *Migration decision making: multidisciplinary approaches to microlevel studies in developed and developing countries*. Elsevier, Elmsford, New York.

Dumon, W. (1986). Problems faced by migrations and their family members, particulary second generation migrants, in returning to and reintegrating into their countries of origin. *International Migration*, 24(1):113–128.

Dustmann, C. (2003). Return migration, wage differentials, and the optimal migration duration. *European Economic Review*, 47(2):353–369.

Elmhirst, R. (2007). Tigers and gangsters: masculinities and feminised migration in indonesia. *Population, Space and Place*, 13(3):225–238.

Elmhirst, R. (2012). Displacement, resettlement, and multi-local livelihoods: positioning mi-

grant legitimacy in lampung, indonesia. *Critical Asian Studies*, 44(1):131–152.

Erikson, K. (1978). *Everything in its path: destruction of community in the Buffalo Creek flood*. Simon and Schuster, New York, NY.

Ezra, M. and Kiros, G.-E. (2001). Rural out-migration in the drought prone areas of ethiopia: A multilevel analysis. *International Migration Review*, 35(3):749–771.

Findlay, A. M. and Wahba, J. (2013). Migration and demographic change. *Population, Space and Place*, 19(6):651–656.

Fussell, E., Sastry, N., and VanLandingham, M. (2010). Race, socioeconomic status, and return migration to new orleans after hurricane katrina. *Population and Environment*, 31(1-3):20–42.

Gardner, R. W. (1981). Macrolevel influences on the migration decision process. In *Migration decision making: multidisciplinary approaches to microlevel studies in developed and developing countries*. Pergamon, New York.

Gray, C., Frankenberg, E., Gillespie, T., Sumantri, C., and Thomas, D. (2014). Studying displacement after a disaster using large-scale survey methods: Sumatra after the 2004 tsunami. *Annals of the Association of American Geographers*, 104(3):594–612.

Hidayati, S. (2011). A year after the 2010 merapi eruption: volcano hazard and indonesian government mitigation measures.

Hugo, G. (1996). Environmental concerns and international migration. *International Migration Review*, pages 105–131.

Hunter, L. M. (2005). Migration and environmental hazards. *Population and Environment*, 26(4):273–302.

Jones, G. W. and Pratomo, D. (2016). Education in indonesia: trends, differentials, and implications for development. In *Contemporary demographic transformations in China, India and Indonesia*, pages 195–214. Springer.

Karimi, S. (2017). Return migration after 30 september 2009 earthquake in west sumatra, indonesia. *Journal of Asian Development*, 3(1):144–155.

Kasarda, J. D. and Janowitz, M. (1974). Community attachment in mass society. *American Sociological Review*, pages 328–339.

Kelly, P. F. (2011). Migration, agrarian transition, and rural change in southeast asia: introduction. *Critical Asian Studies*, 43(4):479–506.

King, R. (2015). *Return migration and regional economic problems*, volume 6. Routledge.

Lee, E. S. (1966). A theory of migration. *Demography*, 3(1):47–57.

Little, P. D., Smith, K., Cellarius, B. A., Coppock, D. L., and Barrett, C. (2001). Avoiding disaster: diversification and risk management among east african herders. *Development and Change*, 32(3):401–433.

Massey, D. S., Arango, J., Hugo, G., Kouaouci, A., Pellegrino, A., and Taylor, J. E. (1993). Theories of international migration: a review and appraisal. *Population and Development Review*, 19(3):431–466.

McLeman, R. A. (2011). Settlement abandonment in the context of global environmental change. *Global Environmental Change*, 21:S108–S120.

Myers, C. A., Slack, T., and Singelmann, J. (2008). Social vulnerability and migration in the wake of disaster: the case of hurricanes katrina and rita. *Population and Environment*, 29(6):271–291.

Nawrotzki, R. J., Brenkert-Smith, H., Hunter, L. M., and Champ, P. A. (2014). Wildfire-migration dynamics: lessons from colorado's fourmile canyon fire. *Society & Natural Resources*, 27(2):215–225.

Oliver-Smith, A. (1990). Post-disaster housing reconstruction and social inequality: a challenge to policy and practice. *Disasters*, 14(1):7–19.

Paul, B. K. (1998). Coping with the 1996 tornado in tangail, bangladesh: an analysis of field data. *The Professional Geographer*, 50(3):287–301.

Paul, B. K. (2005). Evidence against disaster-induced migration: the 2004 tornado in north-central bangladesh. *Disasters*, 29(4):370–385.

Perry, R. W. (2007). What is a disaster? In *Handbook of Disaster Research*, pages 1–15. Springer.

Petersen, W. (1958). A general typology of migration. *American Sociological Review*, 23(3):256–266.

Petersen, W. (1975). *Population*. MacMillian Publishing Company, New York, NY.

Press, A. (2018). Indonesia's mount merapi erupts, prompting evacuations.

Preston, S., Heveline, P. H., and Guillot, M. (2000). *Demography: measuring and modeling population processes*. Wiley-Blackwell, Malden, MA, 1st edition.

Quarantelli, E. L. and Dynes, R. R. (1977). Response to social crisis and disaster. *Annual Review of Sociology*, pages 23–49.

R Core Team (2013). *R: a language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0.

Rahman, M. B., Nurhasanah, I. S., and Nugroho, S. P. (2016). Community resilience: learning

from mt merapi eruption 2010. *Procedia-Social and Behavioral Sciences*, 227:387–394.

Ravenstein, E. G. (1885). The laws of migration. *Journal of the Statistical Society of London*, pages 167–235.

Reagan, P. B. and Olsen, R. J. (2000). You can go home again: evidence from longitudinal data. *Demography*, 37(3):339–350.

Rogers, R. (1992). The future of refugee flows and policies. *International Migration Review*, pages 1112–1143.

Rozdilsky, J. L. (2001). Second hazards assessment and sustainable hazards mitigation: disaster recovery on montserrat. *Natural Hazards Review*, 2(2):64–71.

Ruben, R., Van Houte, M., and Davids, T. (2009). What determines the embeddedness of forced-return migrants? rethinking the role of pre-and post-return assistance. *International Migration Review*, 43(4):908–937.

Sastry, N. and Gregory, J. (2014). The location of displaced new orleans residents in the year after hurricane katrina. *Demography*, 51(3):753–775.

Stark, O. (1991). The migration of labor.

Stark, O. (1996). On the microeconomics of return migration. In *Trade and development*, pages 32–41. Springer.

Statistik, B. P. (2010). *Sensus Penduduk 2010*. Badan Pusat Statistik, Jakarta, Indonesia.

Stevenson, J., Vargo, J., Seville, E., Kachali, H., McNaughton, A., and Powell, F. (2012). The recovery of canterbury's organisations: A comparative analysis of the 4 september 2010, 22 february and 13 june 2011 earthquake.

Stevenson, J. R., Kachali, H., Whitman, Z., Seville, E., Vargo, J., and Wilson, T. (2011). Preliminary observations of the impacts the 22 february christchurch earthquake had on organisations and the economy: A report from the field (22 february-22 march 2011). *Bulletin of the New Zealand Society for Earthquake Engineering*, 44(2):65.

Suryadinata, L., Arifin, E. N., and Ananta, A. (2003). *Indonesia's population: ethnicity and religion in a changing political landscape*. Number 1. Institute of Southeast Asian Studies.

Taylor, J. E. (1996). *Development strategy, employment and migration: insights from models.* Paris France Organisation for Economic Co-operation and Development [OECD] 1996.

Van Lottum, J. and Marks, D. (2012). The determinants of internal migration in a developing country: quantitative evidence for indonesia, 1930–2000. *Applied Economics*, 44(34):4485–4494.

Weng Chan, N. (1995). Flood disaster management in malaysia: an evaluation of the effect-

iveness of government resettlement schemes. *Disaster Prevention and Management: An International Journal*, 4(4):22–29.

Tables

Table 1. Descriptive Statistics: Categorical Variables

n (%)	Level	Moved Home	In Transition	Moved On	Displaced	Total
		190	24	22	162	398
NGO Recovery Aid	Not Received	74 (38.9)	11 (45.8)	11 (50.0)	85 (52.5)	181 (45.5)
	Received	116 (61.1)	13 (54.2)	11 (50.0)	77 (47.5)	217 (54.5)
Government Recovery Aid	Not Received	48 (25.3)	11 (45.8)	5 (22.7)	49 (30.2)	113 (28.4)
	Received	142 (74.7)	13 (54.2)	17 (77.3)	113 (69.8)	285 (71.6)
Financial Aid	Not Received	138 (72.6)	18 (75.0)	6 (27.3)	53 (32.7)	215 (54.0)
	Received	52 (27.4)	6 (25.0)	16 (72.7)	109 (67.3)	183 (46.0)
Health Aid	Not Received	88 (46.3)	11 (45.8)	7 (31.8)	29 (17.9)	135 (33.9)
	Received	102 (53.7)	13 (54.2)	15 (68.2)	133 (82.1)	263 (66.1)
Food Aid	Not Received	77 (40.5)	12 (50.0)	8 (36.4)	47 (29.0)	144 (36.2)
	Received	113 (59.5)	12 (50.0)	14 (63.6)	115 (71.0)	254 (63.8)
Remittances	Not Received	159 (83.7)	22 (91.7)	18 (81.8)	145 (89.5)	344 (86.4)
	Received	31 (16.3)	2 (8.3)	4 (18.2)	17 (10.5)	54 (13.6)
Age	18-30	27 (14.2)	3 (12.5)	7 (31.8)	26 (16.0)	63 (15.8)
	31-40	42 (22.1)	1 (4.2)	6 (27.3)	42 (25.9)	91 (22.9)
	41-50	46 (24.2)	8 (33.3)	6 (27.3)	30 (18.5)	90 (22.6)
	51-60	48 (25.3)	5 (20.8)	1 (4.5)	37 (22.8)	91 (22.9)
	61-70	19 (10.0)	5 (20.8)	1 (4.5)	20 (12.3)	45 (11.3)
	70+	8 (4.2)	2 (8.3)	1 (4.5)	7 (4.3)	18 (4.5)
Sex	Female	75 (39.5)	6 (25.0)	14 (63.6)	61 (37.7)	156 (39.2)
	Male	115 (60.5)	18 (75.0)	8 (36.4)	101 (62.3)	242 (60.8)
Married	Other	17 (8.9)	1 (4.2)	2 (9.1)	24 (14.8)	44 (11.1)
	Married	173 (91.1)	23 (95.8)	20 (90.9)	138 (85.2)	354 (88.9)
Education	Primary School or Less	66 (34.7)	9 (37.5)	7 (31.8)	55 (34.0)	137 (34.4)
	Junior High School	37 (19.5)	7 (29.2)	6 (27.3)	57 (35.2)	107 (26.9)
	Senior High School	70 (36.8)	7 (29.2)	9 (40.9)	45 (27.8)	131 (32.9)
	Beyond High School	17 (8.9)	1 (4.2)	0 (0.0)	5 (3.1)	23 (5.8)
Income	0 - 500,000	50 (26.3)	6 (25.0)	5 (22.7)	48 (29.6)	109 (27.4)
	500,001 - 800,000	57 (30.0)	5 (20.8)	2 (9.1)	44 (27.2)	108 (27.1)
	800,001 - 1,000,000	35 (18.4)	9 (37.5)	3 (13.6)	43 (26.5)	90 (22.6)
	1,000,000+	48 (25.3)	4 (16.7)	12 (54.5)	27 (16.7)	91 (22.9)
Residence Duration	Less than Whole Life	81 (42.6)	9 (37.5)	14 (63.6)	74 (45.7)	178 (44.7)
	Whole Life	109 (57.4)	15 (62.5)	8 (36.4)	88 (54.3)	220 (55.3)
Environmental Hazards	1	80 (42.1)	11 (45.8)	6 (27.3)	49 (30.2)	146 (36.7)
	2	91 (47.9)	10 (41.7)	13 (59.1)	41 (25.3)	155 (38.9)
	3+	19 (10.0)	3 (12.5)	3 (13.6)	72 (44.4)	97 (24.4)
Perceived Destruction	Low	168 (88.4)	14 (58.3)	14 (63.6)	13 (8.0)	209 (52.5)
	Medium	15 (7.9)	8 (33.3)	5 (22.7)	20 (12.3)	48 (12.1)
	High	7 (3.7)	2 (8.3)	3 (13.6)	129 (79.6)	141 (35.4)
Fears Nature's Wrath	No	59 (31.1)	7 (29.2)	5 (22.7)	55 (34.0)	126 (31.7)
	Yes	131 (68.9)	17 (70.8)	17 (77.3)	107 (66.0)	272 (68.3)
Residence Damaged	No	150 (78.9)	14 (58.3)	13 (59.1)	16 (9.9)	193 (48.5)
	Yes	40 (21.1)	10 (41.7)	9 (40.9)	146 (90.1)	205 (51.5)

Table 2. Multinomial Logistic Regression Results for Migration Status and NGO Recovery Aid

	Dependent variable: Migration Status					
	In Transition (Model 1)	Moved On (Model 1)	Displaced (Model 1)	In Transition (Model 2)	Moved On (Model 2)	Displaced (Model 2)
NGO Recovery Aid	0.80 (0.46)	0.72 (0.49)	0.60* (0.23)	0.78 (0.49)	0.61 (0.51)	0.56 (0.40)
Age: 31-40	0.23 (1.19)	0.54 (0.66)	1.38 (0.37)	0.21 (1.21)	0.46 (0.70)	0.70 (0.64)
Age: 41-50	1.88 (0.75)	0.39 (0.67)	0.96 (0.38)	1.29 (0.78)	0.35 (0.69)	0.70 (0.64)
Age: 51-60	1.00 (0.81)	0.06* (1.15)	0.98 (0.38)	0.72 (0.85)	0.05* (1.18)	0.50 (0.68)
Age: 61-70	2.09 (0.84)	0.23 (1.18)	1.37 (0.45)	1.53 (0.88)	0.19 (1.21)	0.66 (0.75)
Age: 70+	2.31 (1.08)	0.36 (1.24)	0.86 (0.63)	1.83 (1.16)	0.24 (1.32)	0.16 (1.04)
Sex (Male)	1.86 (0.65)	0.64 (0.68)	1.36 (0.31)	1.86 (0.68)	0.71 (0.76)	2.02 (0.55)
Marital Status (Married)	2.12 (1.10)	0.56 (0.86)	0.43* (0.37)	3.14 (1.17)	0.68 (0.94)	0.55 (0.60)
Junior High School	1.39 (0.59)	1.77 (0.67)	1.89* (0.30)	1.33 (0.66)	1.36 (0.75)	1.30 (0.53)
Senior High School +	0.74 (0.57)	0.64 (0.59)	0.73 (0.28)	0.63 (0.62)	0.58 (0.63)	0.58 (0.50)
Income: 500,001-800,000 RP	0.71 (0.66)	0.30 (0.90)	0.70 (0.30)	0.87 (0.69)	0.26 (0.94)	0.77 (0.53)
Income: 800,001-1,000,000 RP	2.37 (0.60)	0.74 (0.79)	1.28 (0.32)	2.01 (0.64)	0.72 (0.81)	1.00 (0.55)
Income: 1,000,000+ RP	0.66 (0.71)	3.68* (0.61)	0.70 (0.34)	0.76 (0.74)	3.69* (0.64)	0.66 (0.58)
Residence Duration	0.86 (0.58)	0.62 (0.67)	0.65 (0.30)	0.81 (0.59)	0.54 (0.73)	0.41 (0.51)
Environmental Hazards				0.72 (0.36)	1.16 (0.37)	1.20 (0.27)
Medium Destruction				6.90** (0.67)	2.78 (0.75)	6.65*** (0.56)
High Destruction				3.67 (0.98)	4.31 (0.92)	104.09*** (0.58)
Fears Nature's Wrath				0.99 (0.53)	2.10 (0.61)	1.27 (0.43)
Residence Damaged				1.25 (0.61)	1.67 (0.63)	4.68** (0.48)
Constant	0.04* (1.34)	0.75 (1.06)	2.42 (0.51)	0.04* (1.54)	0.28 (1.32)	0.16 (0.99)
Akaike Inf. Crit.	849.11	849.11	849.11	571.43	571.43	571.43

Note: *p<0.05; **p<0.01; ***p<0.001

Table 3. Multinomial Logistic Regression Results for Migration Status and Government Recovery Aid

	Dependent variable: Migration Status					
	In Transition (Model 1)	Moved On (Model 1)	Displaced (Model 1)	In Transition (Model 2)	Moved On (Model 2)	Displaced (Model 2)
Government Recovery Aid	0.38* (0.47)	1.14 (0.58)	0.79 (0.25)	0.41 (0.52)	1.61 (0.63)	2.54* (0.47)
Age: 31-40	0.20 (1.20)	0.54 (0.66)	1.35 (0.37)	0.21 (1.22)	0.44 (0.70)	0.77 (0.64)
Age: 41-50	1.56 (0.76)	0.38 (0.67)	0.93 (0.38)	1.12 (0.79)	0.32 (0.70)	0.77 (0.65)
Age: 51-60	0.84 (0.82)	0.05* (1.15)	0.96 (0.38)	0.61 (0.86)	0.05* (1.18)	0.58 (0.69)
Age: 61-70	1.78 (0.85)	0.22 (1.18)	1.30 (0.45)	1.27 (0.90)	0.18 (1.21)	0.64 (0.76)
Age: 70+	1.66 (1.09)	0.40 (1.25)	0.86 (0.64)	1.41 (1.16)	0.34 (1.35)	0.21 (1.10)
Sex (Male)	1.91 (0.67)	0.62 (0.68)	1.34 (0.31)	1.98 (0.71)	0.65 (0.76)	1.98 (0.56)
Marital Status (Married)	2.35 (1.11)	0.57 (0.86)	0.47* (0.37)	3.09 (1.19)	0.69 (0.93)	0.54 (0.60)
Junior High School	1.25 (0.60)	1.78 (0.67)	1.95* (0.30)	1.16 (0.67)	1.55 (0.75)	1.52 (0.53)
Senior High School +	0.71 (0.58)	0.63 (0.58)	0.71 (0.28)	0.62 (0.62)	0.59 (0.63)	0.56 (0.50)
Income: 500,001-800,000 RP	0.76 (0.67)	0.31 (0.90)	0.72 (0.30)	1.05 (0.72)	0.27 (0.94)	0.73 (0.54)
Income: 800,001-1,000,000 RP	2.63 (0.61)	0.72 (0.79)	1.32 (0.32)	2.51 (0.66)	0.70 (0.82)	0.95 (0.55)
Income: 1,000,000+ RP	0.79 (0.72)	3.69* (0.62)	0.72 (0.34)	0.89 (0.76)	3.65* (0.64)	0.63 (0.58)
Residence Duration	0.96 (0.60)	0.62 (0.68)	0.67 (0.30)	0.84 (0.61)	0.54 (0.74)	0.38 (0.52)
Environmental Hazards				0.73 (0.37)	1.07 (0.37)	1.15 (0.27)
Medium Destruction				8.28** (0.70)	2.95 (0.75)	6.51*** (0.57)
High Destruction				3.58 (0.98)	4.70 (0.92)	122.91*** (0.59)
Fears Nature's Wrath				0.87 (0.54)	2.12 (0.61)	1.36 (0.44)
Residence Damaged				0.97 (0.63)	1.84 (0.63)	5.12*** (0.49)
Constant	0.06* (1.32)	0.58 (1.09)	2.04 (0.51)	0.07 (1.54)	0.16 (1.35)	0.05** (1.03)
Akaike Inf. Crit.	849.85	849.85	849.85	564.54	564.54	564.54

Note: *p<0.05; **p<0.01; ***p<0.001

Table 4. Multinomial Logistic Regression Results for Migration Status and Financial Recovery Aid

	Dependent variable: Migration Status					
	In Transition	Moved On	Displaced	In Transition	Moved On	Displaced
	(Model 1)	(Model 1)	(Model 1)	(Model 2)	(Model 2)	(Model 2)
Financial Recovery Aid	0.94 (0.52)	8.99*** (0.56)	6.87*** (0.26)	0.59 (0.59)	11.62*** (0.62)	5.09*** (0.43)
Age: 31-40	0.23 (1.20)	0.77 (0.69)	1.92 (0.41)	0.20 (1.22)	0.63 (0.75)	0.95 (0.67)
Age: 41-50	1.76 (0.76)	0.42 (0.70)	1.11 (0.42)	1.03 (0.81)	0.34 (0.74)	0.86 (0.67)
Age: 51-60	0.89 (0.81)	0.05* (1.18)	1.03 (0.41)	0.64 (0.85)	0.04** (1.22)	0.57 (0.70)
Age: 61-70	1.91 (0.85)	0.34 (1.20)	1.76 (0.49)	1.34 (0.89)	0.23 (1.25)	0.73 (0.78)
Age: 70+	2.55 (1.07)	0.75 (1.29)	1.52 (0.68)	1.92 (1.14)	0.41 (1.35)	0.27 (1.05)
Sex (Male)	1.77 (0.66)	0.58 (0.71)	1.29 (0.34)	1.85 (0.69)	0.74 (0.82)	1.85 (0.57)
Marital Status (Married)	2.31 (1.12)	0.42 (0.88)	0.36** (0.40)	3.84 (1.20)	0.47 (0.98)	0.47 (0.61)
Junior High School	1.43 (0.58)	1.55 (0.70)	1.64 (0.33)	1.48 (0.65)	0.90 (0.83)	1.06 (0.56)
Senior High School +	0.71 (0.58)	0.48 (0.62)	0.50* (0.31)	0.64 (0.63)	0.37 (0.70)	0.43 (0.53)
Income: 500,001-800,000 RP	0.76 (0.66)	0.36 (0.90)	0.71 (0.33)	1.01 (0.71)	0.33 (0.96)	0.77 (0.57)
Income: 800,001-1,000,000 RP	2.48 (0.61)	0.82 (0.81)	1.41 (0.35)	2.25 (0.65)	0.82 (0.86)	1.08 (0.58)
Income: 1,000,000+ RP	0.70 (0.71)	4.39* (0.65)	0.75 (0.37)	0.81 (0.74)	4.89* (0.72)	0.75 (0.61)
Residence Duration	0.89 (0.58)	0.63 (0.71)	0.63 (0.33)	0.90 (0.60)	0.44 (0.82)	0.37 (0.55)
Environmental Hazards				0.68 (0.37)	0.97 (0.41)	1.12 (0.28)
Medium Destruction				8.30** (0.73)	2.37 (0.77)	5.73** (0.57)
High Destruction				3.32 (1.03)	4.44 (0.97)	110.37*** (0.63)
Fears Nature's Wrath				0.82 (0.55)	3.41 (0.66)	1.63 (0.46)
Residence Damaged				1.26 (0.63)	1.29 (0.67)	3.98** (0.50)
Constant	0.03* (1.31)	0.25 (1.11)	0.90 (0.53)	0.04* (1.53)	0.10 (1.40)	0.07** (1.01)
Akaike Inf. Crit.	779.36	779.36	779.36	541.88	541.88	541.88

Note: *p<0.05; **p<0.01; ***p<0.001

Table 5. Multinomial Logistic Regression Results for Migration Status and Health Recovery Aid

	Dependent variable: Migration Status					
	In Transition	Moved On	Displaced	In Transition	Moved On	Displaced
	(Model 1)	(Model 1)	(Model 1)	(Model 2)	(Model 2)	(Model 2)
Health Recovery Aid	1.17 (0.46)	2.29 (0.53)	4.27*** (0.27)	0.86 (0.51)	2.45 (0.57)	4.16** (0.49)
Age: 31-40	0.23 (1.20)	0.56 (0.66)	1.52 (0.38)	0.21 (1.22)	0.51 (0.70)	0.87 (0.65)
Age: 41-50	1.78 (0.75)	0.39 (0.67)	1.07 (0.40)	1.24 (0.78)	0.35 (0.71)	0.86 (0.66)
Age: 51-60	0.94 (0.82)	0.06* (1.16)	1.11 (0.40)	0.69 (0.85)	0.05* (1.19)	0.62 (0.69)
Age: 61-70	2.13 (0.85)	0.25 (1.18)	1.57 (0.47)	1.57 (0.88)	0.21 (1.22)	0.86 (0.75)
Age: 70+	2.39 (1.10)	0.52 (1.26)	1.55 (0.66)	2.00 (1.16)	0.38 (1.37)	0.26 (1.10)
Sex (Male)	1.71 (0.66)	0.57 (0.69)	1.11 (0.32)	1.89 (0.70)	0.55 (0.76)	1.59 (0.55)
Marital Status (Married)	2.21 (1.11)	0.57 (0.86)	0.44* (0.38)	3.68 (1.18)	0.63 (0.93)	0.45 (0.61)
Junior High School	1.41 (0.59)	1.98 (0.68)	2.23* (0.31)	1.38 (0.64)	1.68 (0.76)	1.73 (0.53)
Senior High School +	0.74 (0.58)	0.69 (0.59)	0.81 (0.29)	0.60 (0.62)	0.63 (0.64)	0.69 (0.51)
Income: 500,001-800,000 RP	0.73 (0.66)	0.30 (0.90)	0.71 (0.31)	0.89 (0.69)	0.26 (0.95)	0.81 (0.54)
Income: 800,001-1,000,000 RP	2.35 (0.61)	0.81 (0.79)	1.58 (0.34)	2.01 (0.65)	0.80 (0.82)	1.19 (0.57)
Income: 1,000,000+ RP	0.68 (0.71)	3.95* (0.62)	0.79 (0.35)	0.76 (0.74)	4.23* (0.66)	0.76 (0.59)
Residence Duration	0.89 (0.59)	0.64 (0.67)	0.73 (0.31)	0.83 (0.60)	0.56 (0.72)	0.43 (0.52)
Environmental Hazards				0.71 (0.36)	1.05 (0.37)	1.15 (0.28)
Medium Destruction				7.65** (0.69)	3.01 (0.74)	6.93*** (0.57)
High Destruction				3.89 (0.99)	4.87 (0.93)	127.05*** (0.61)
Fears Nature's Wrath				0.94 (0.53)	2.19 (0.61)	1.43 (0.45)
Residence Damaged				1.19 (0.62)	1.46 (0.63)	3.75** (0.49)
Constant	0.03* (1.36)	0.34 (1.10)	0.53 (0.56)	0.04* (1.53)	0.14 (1.33)	0.04** (1.07)
Akaike Inf. Crit.	820.55	820.55	820.55	562.43	562.43	562.43

Note: *p<0.05; **p<0.01; ***p<0.001

Table 6. Multinomial Logistic Regression Results for Migration Status and Food Recovery Aid

	Dependent variable: Migration Status					
	In Transition (Model 1)	Moved On (Model 1)	Displaced (Model 1)	In Transition (Model 2)	Moved On (Model 2)	Displaced (Model 2)
Food Recovery Aid	0.70 (0.45)	1.33 (0.50)	1.55 (0.24)	0.70 (0.48)	1.58 (0.52)	1.68 (0.42)
Age: 31-40	0.22 (1.20)	0.53 (0.66)	1.38 (0.37)	0.22 (1.21)	0.46 (0.70)	0.75 (0.63)
Age: 41-50	1.80 (0.75)	0.38 (0.66)	0.97 (0.38)	1.26 (0.78)	0.34 (0.70)	0.74 (0.65)
Age: 51-60	1.01 (0.81)	0.05* (1.15)	0.96 (0.38)	0.77 (0.84)	0.05* (1.18)	0.52 (0.68)
Age: 61-70	2.03 (0.84)	0.23 (1.18)	1.39 (0.45)	1.47 (0.88)	0.19 (1.21)	0.70 (0.75)
Age: 70+	2.40 (1.08)	0.39 (1.24)	0.97 (0.63)	2.07 (1.14)	0.28 (1.32)	0.20 (1.06)
Sex (Male)	1.79 (0.65)	0.60 (0.68)	1.29 (0.31)	1.88 (0.68)	0.66 (0.76)	1.82 (0.55)
Marital Status (Married)	2.15 (1.10)	0.60 (0.86)	0.48* (0.37)	3.39 (1.18)	0.69 (0.92)	0.56 (0.59)
Junior High School	1.40 (0.58)	1.77 (0.67)	1.93* (0.30)	1.43 (0.65)	1.42 (0.75)	1.41 (0.53)
Senior High School +	0.73 (0.57)	0.63 (0.58)	0.71 (0.28)	0.63 (0.61)	0.56 (0.64)	0.56 (0.50)
Income: 500,001-800,000 RP	0.72 (0.66)	0.30 (0.90)	0.70 (0.30)	0.85 (0.69)	0.27 (0.95)	0.78 (0.54)
Income: 800,001-1,000,000 RP	2.38 (0.61)	0.73 (0.79)	1.28 (0.32)	2.05 (0.64)	0.70 (0.82)	1.01 (0.55)
Income: 1,000,000+ RP	0.66 (0.71)	3.72* (0.61)	0.72 (0.34)	0.72 (0.74)	3.90* (0.64)	0.71 (0.58)
Residence Duration	0.86 (0.58)	0.65 (0.68)	0.68 (0.30)	0.82 (0.59)	0.55 (0.73)	0.42 (0.52)
Environmental Hazards				0.72 (0.36)	1.05 (0.37)	1.16 (0.27)
Medium Destruction				7.08** (0.69)	3.06 (0.74)	7.30*** (0.56)
High Destruction				3.83 (1.00)	4.60 (0.91)	109.92*** (0.58)
Fears Nature's Wrath				0.96 (0.52)	2.19 (0.62)	1.32 (0.44)
Residence Damaged				1.21 (0.62)	1.69 (0.62)	4.44** (0.48)
Constant	0.05* (1.34)	0.50 (1.09)	1.26 (0.52)	0.04* (1.54)	0.17 (1.31)	0.08* (0.99)
Akaike Inf. Crit.	849.34	849.34	849.34	570.82	570.82	570.82

Note: *p<0.05; **p<0.01; ***p<0.001

Table 7. Multinomial Logistic Regression Results for Migration Status and Remittances

	Dependent variable: Migration Status					
	In Transition (Model 1)	Moved On (Model 1)	Displaced (Model 1)	In Transition (Model 2)	Moved On (Model 2)	Displaced (Model 2)
Remittances	0.43 (0.78)	1.33 (0.65)	0.66 (0.34)	0.38 (0.85)	1.74 (0.69)	0.87 (0.59)
Age: 31-40	0.21 (1.20)	0.55 (0.67)	1.29 (0.37)	0.19 (1.22)	0.52 (0.72)	0.75 (0.64)
Age: 41-50	1.75 (0.75)	0.39 (0.67)	0.92 (0.38)	1.21 (0.78)	0.36 (0.70)	0.72 (0.64)
Age: 51-60	0.98 (0.81)	0.06* (1.15)	0.98 (0.38)	0.72 (0.84)	0.05* (1.18)	0.53 (0.67)
Age: 61-70	1.95 (0.84)	0.21 (1.19)	1.29 (0.45)	1.34 (0.88)	0.19 (1.22)	0.64 (0.74)
Age: 70+	2.31 (1.08)	0.38 (1.24)	0.92 (0.63)	1.99 (1.13)	0.27 (1.34)	0.18 (1.06)
Sex (Male)	1.94 (0.66)	0.65 (0.68)	1.34 (0.31)	2.02 (0.69)	0.67 (0.75)	1.97 (0.55)
Marital Status (Married)	2.11 (1.10)	0.58 (0.86)	0.46* (0.37)	2.97 (1.16)	0.70 (0.93)	0.58 (0.60)
Junior High School	1.37 (0.58)	1.73 (0.67)	1.95* (0.30)	1.33 (0.64)	1.48 (0.75)	1.44 (0.52)
Senior High School +	0.74 (0.58)	0.63 (0.59)	0.72 (0.28)	0.62 (0.62)	0.56 (0.63)	0.57 (0.50)
Income: 500,001-800,000 RP	0.74 (0.66)	0.31 (0.89)	0.72 (0.30)	0.91 (0.70)	0.28 (0.94)	0.77 (0.53)
Income: 800,001-1,000,000 RP	2.40 (0.60)	0.76 (0.79)	1.29 (0.32)	2.20 (0.64)	0.73 (0.82)	1.01 (0.55)
Income: 1,000,000+ RP	0.68 (0.71)	3.68* (0.61)	0.70 (0.33)	0.76 (0.74)	3.81* (0.64)	0.68 (0.58)
Residence Duration	0.87 (0.58)	0.60 (0.68)	0.66 (0.30)	0.83 (0.60)	0.54 (0.73)	0.40 (0.52)
Environmental Hazards				0.72 (0.36)	1.05 (0.37)	1.20 (0.27)
Medium Destruction				7.80** (0.68)	3.06 (0.74)	6.98*** (0.56)
High Destruction				3.98 (0.99)	4.13 (0.93)	106.19*** (0.58)
Fears Nature's Wrath				0.99 (0.52)	2.08 (0.61)	1.28 (0.43)
Residence Damaged				1.08 (0.63)	1.79 (0.63)	4.52** (0.48)
Constant	0.04* (1.30)	0.59 (1.04)	1.88 (0.49)	0.04* (1.51)	0.20 (1.30)	0.11* (0.96)
Akaike Inf. Crit.	851.40	851.40	851.40	571.54	571.54	571.54

Note: *p<0.05; **p<0.01; ***p<0.001

Figures

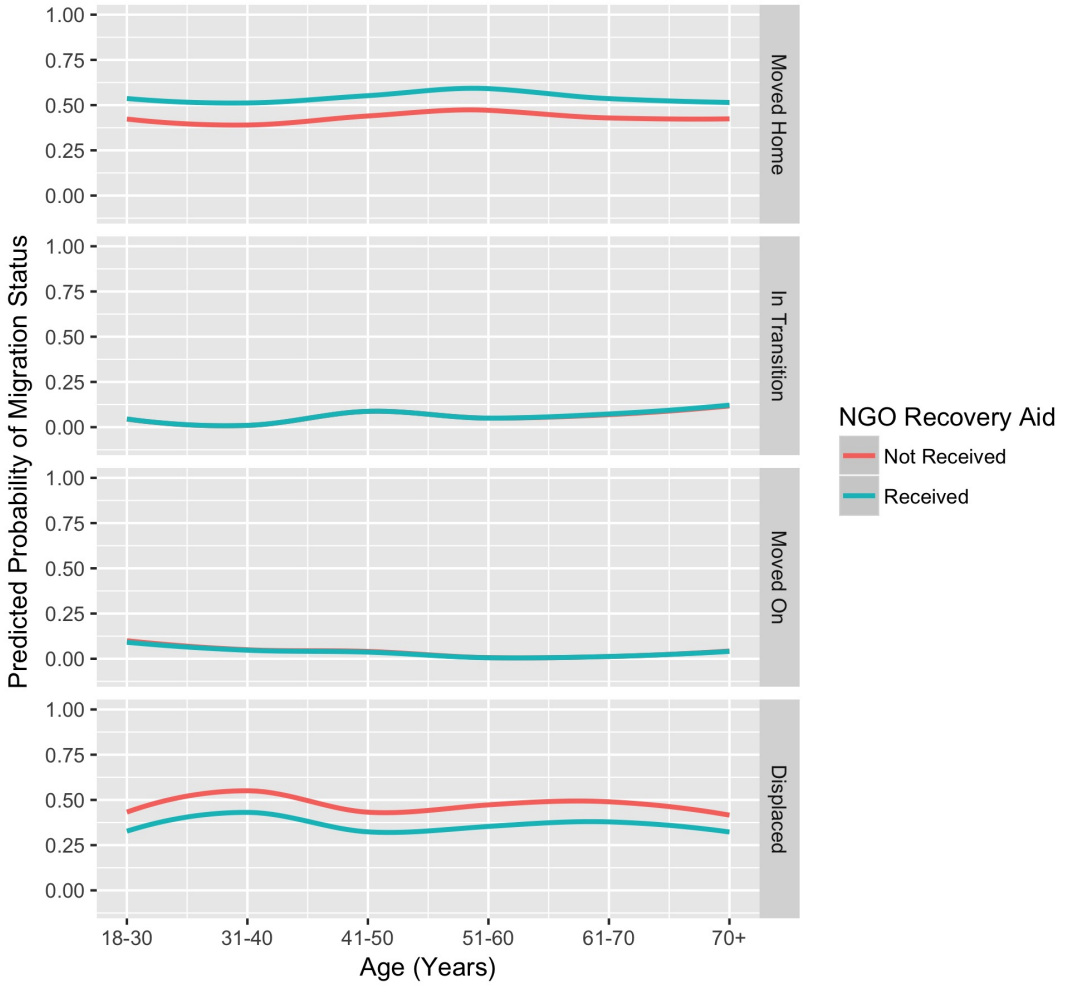

Figure 1. Predicted probabilities of *Migration Status* by *NGO Recovery Aid*. Clear bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *NGO Recovery Aid* associated with having moved home. No discernible difference was seen for *In Transition* or *Moved On*. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts.

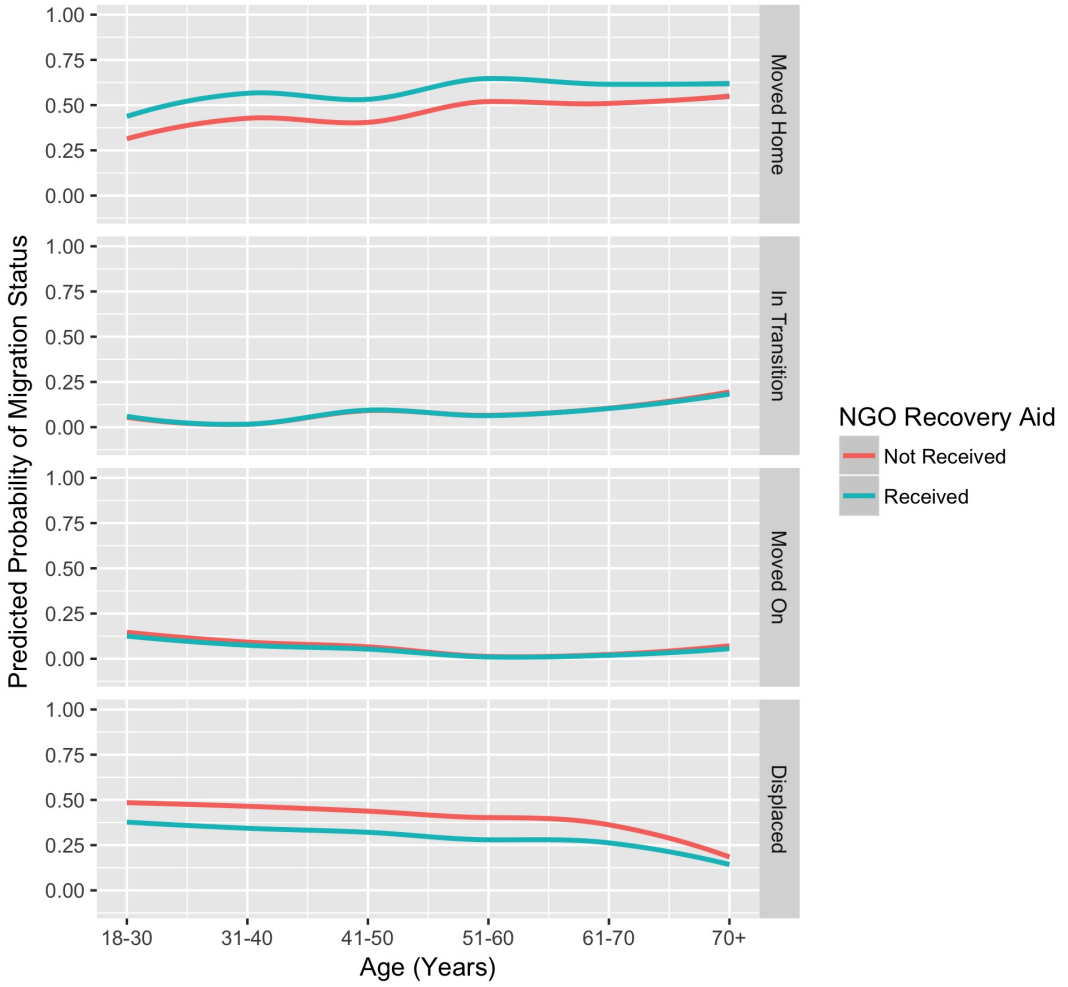

Figure 2. Predicted probabilities of *Migration Status* by *NGO Recovery Aid*. Consistent with Figure 1, clear bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *NGO Recovery Aid* associated with having moved home. No discernible difference was seen for *In Transition* or *Moved On*. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts as well as factors often associated with migration in the contexts of disasters.

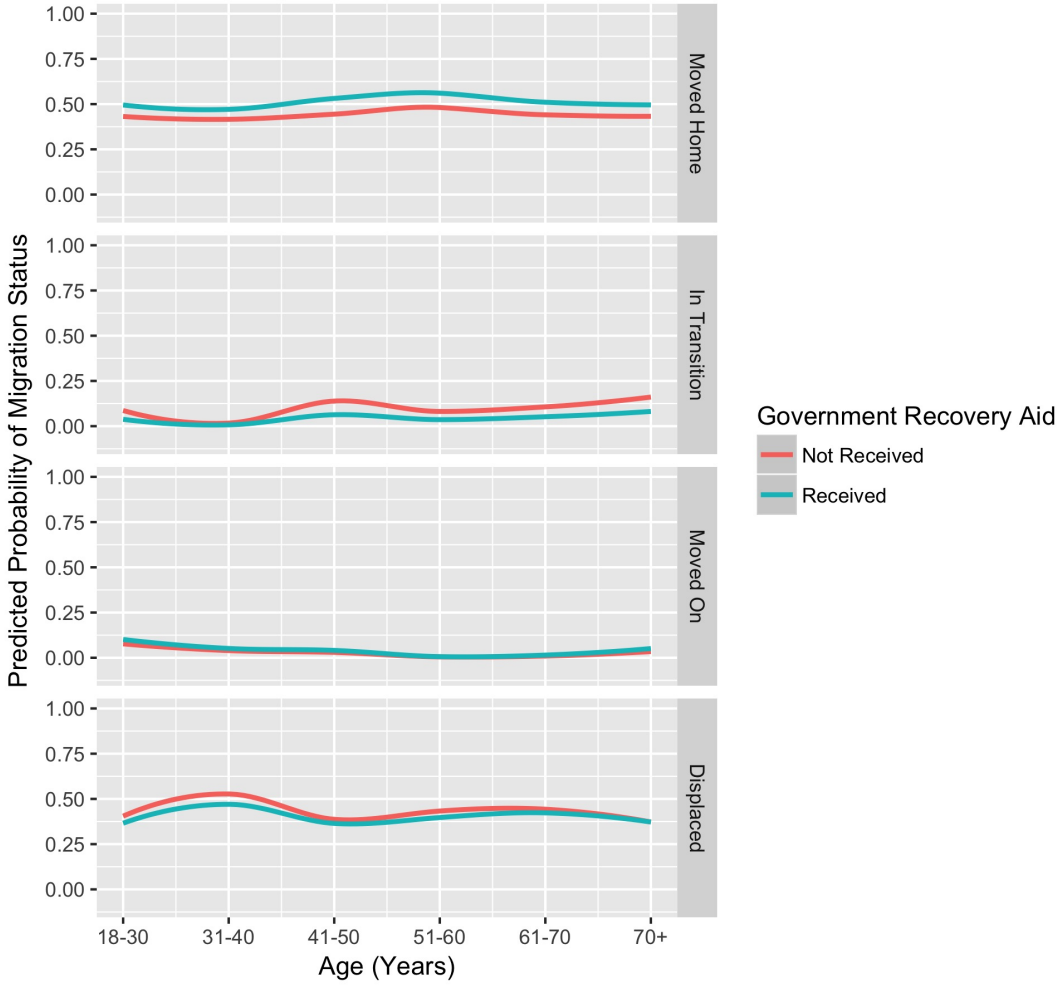

Figure 3. Predicted probabilities of *Migration Status* by *Government Recovery Aid*. Slight bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *Government Recovery Aid* associated with having moved home. Minimal difference was seen for *In Transition* or *Moved On*. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts.

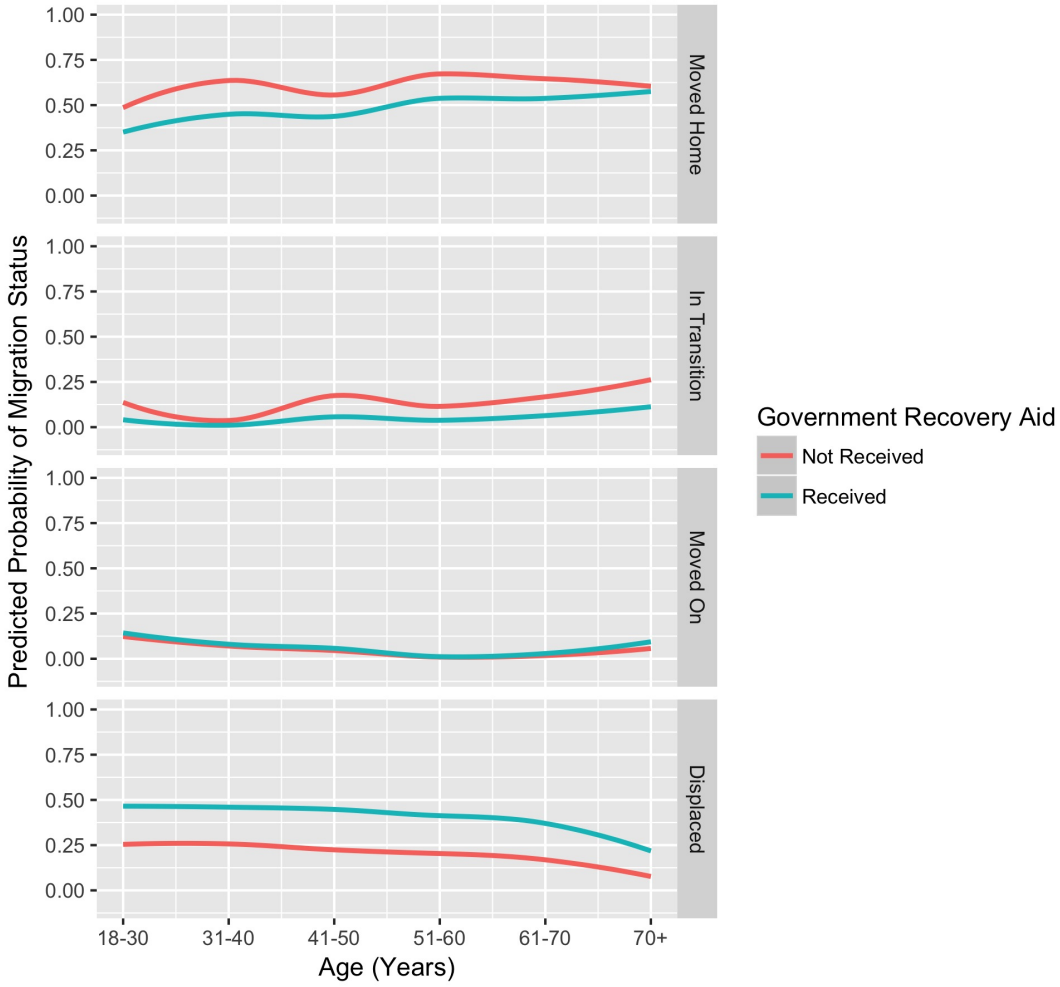

Figure 4. Predicted probabilities of *Migration Status* by *Government Recovery Aid*. In contrast to Figure 3, after adjusting for factors often associated with migration in general contexts as well as factors often associated with migration in the contexts of disasters, having received *Government Recovery Aid* was associated with being *Displaced* as opposed to having *Moved Home* or being *In Transition*, with large bifurcations in predicted probabilities present. No discernible difference was seen for having *Moved On*.

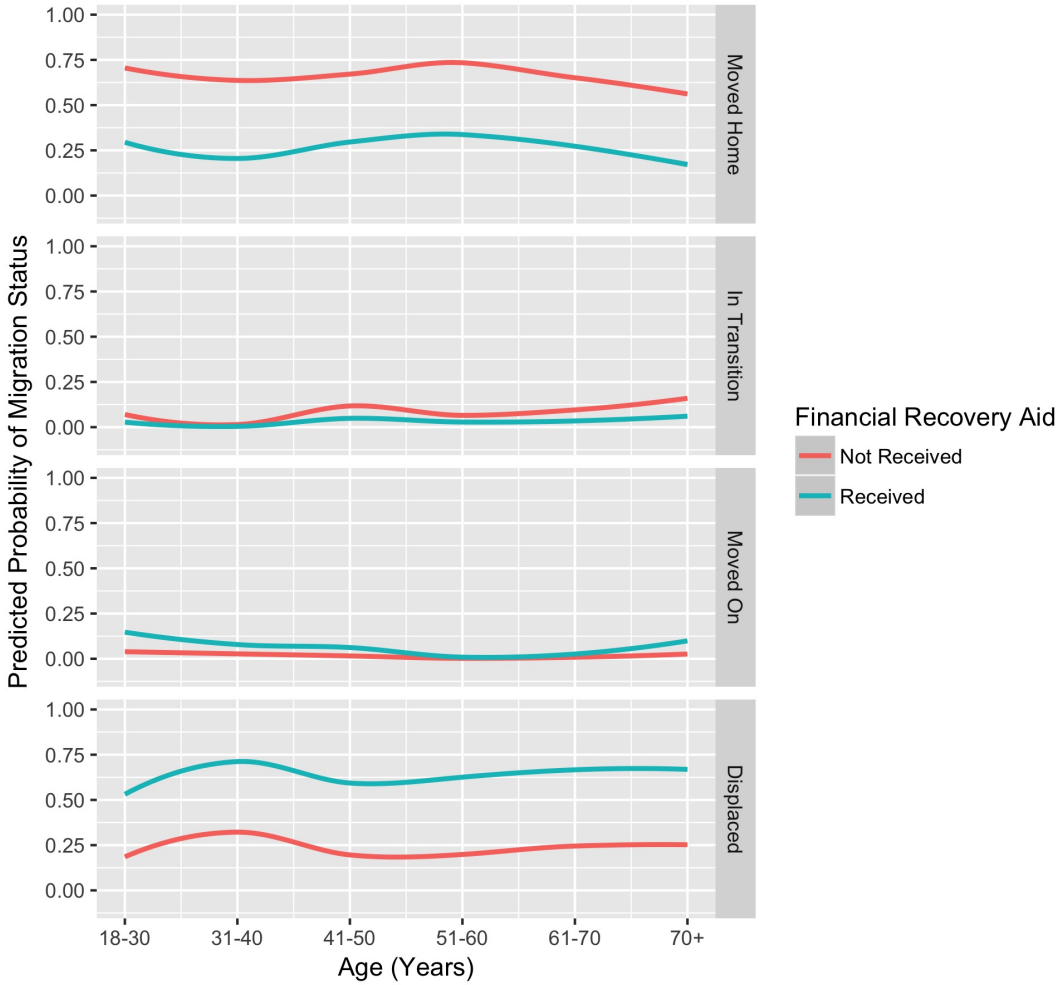

Figure 5. Predicted probabilities of *Migration Status* by *Financial Recovery Aid*. Large bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *Financial Recovery Aid* associated with being *Displaced*. However, having received *Financial Recovery Aid* was also associated with a slight bifurcation in predicted probability for *Moved On* for younger and older age groups. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts.

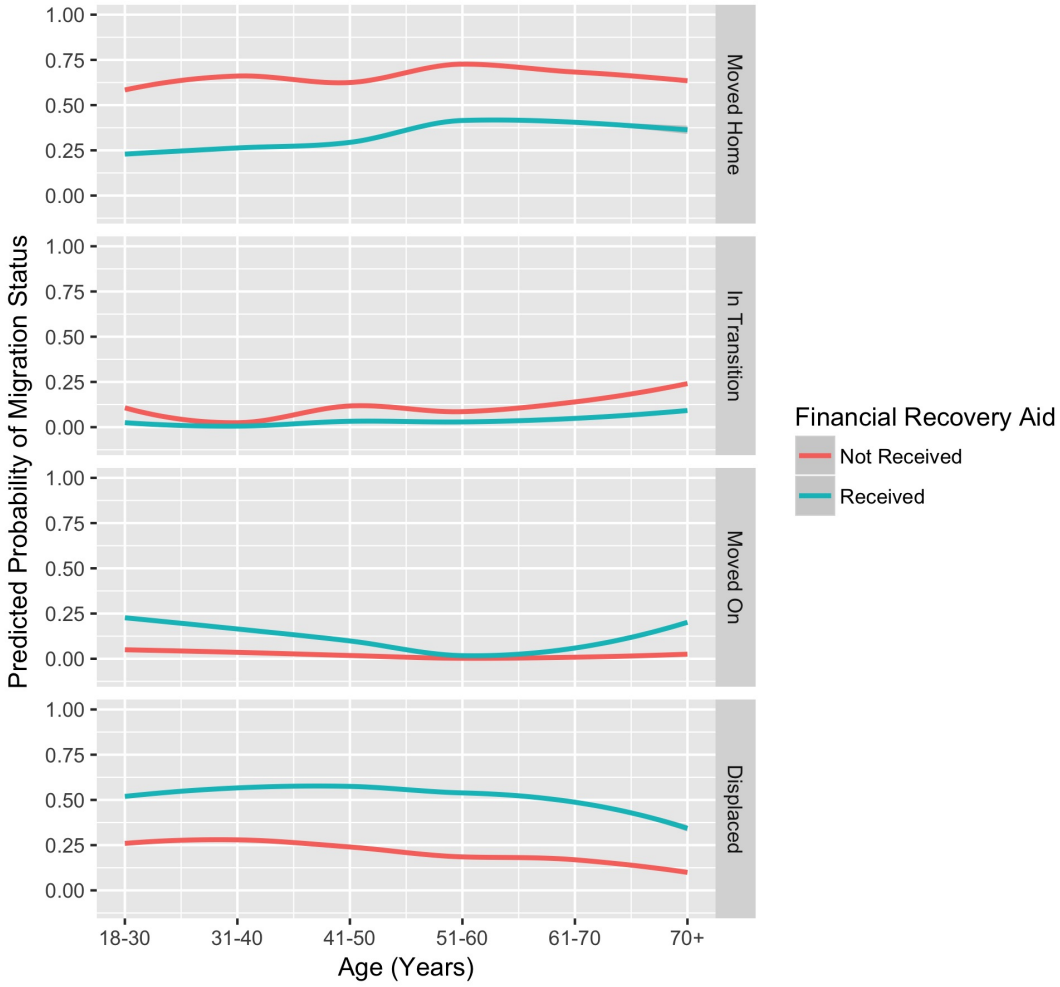

Figure 6. Predicted probabilities of *Migration Status* by *Financial Recovery Aid*. Consistent with Figure 5, clear bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *Financial Recovery Aid* associated with being *Displaced*. Moreover, after adjusting for factors often associated with migration in the contexts of disasters, having received *Financial Recovery Aid* was also associated with a large bifurcation in predicted probability for *Moved On* for younger and older age groups.

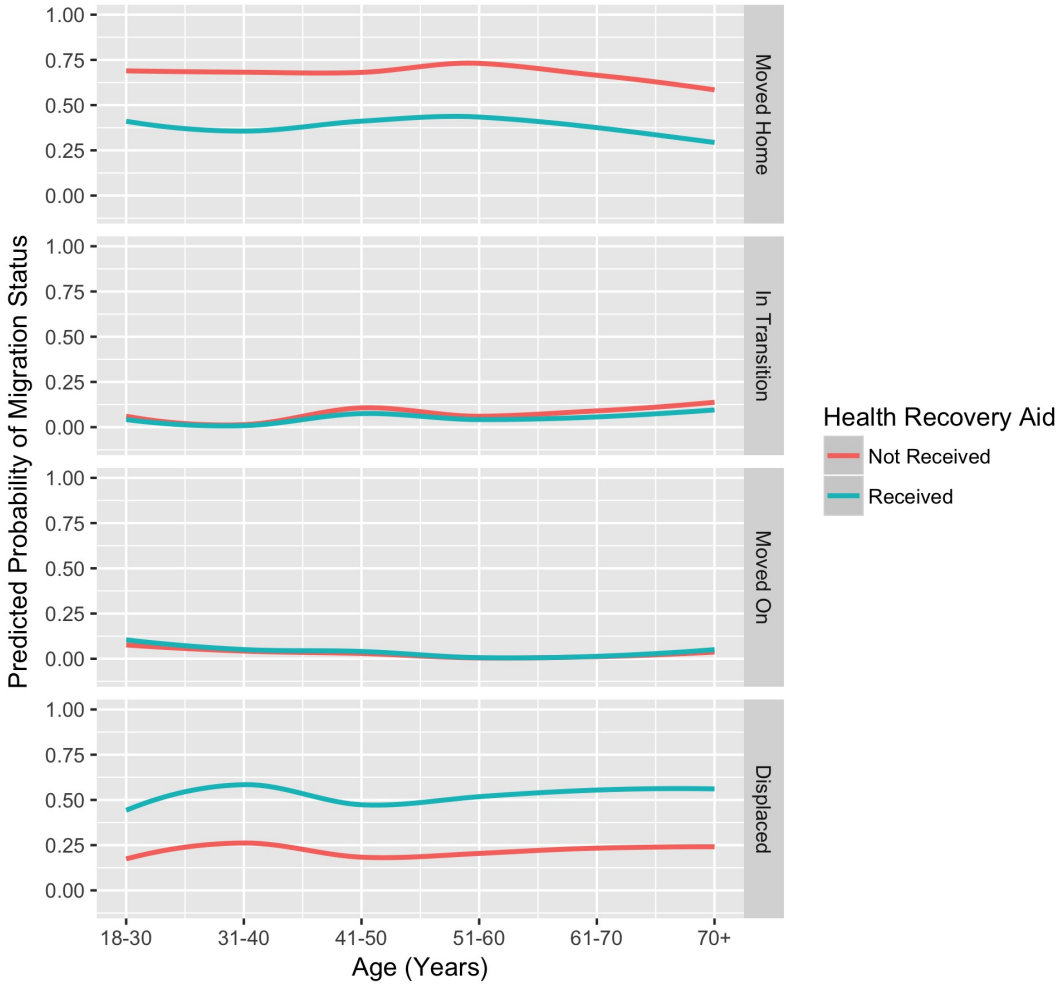

Figure 7. Predicted probabilities of *Migration Status* by *Health Recovery Aid*. Clear bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *Health Recovery Aid* associated with being *Displaced*. No discernible difference was seen for *In Transition* or *Moved On*. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts.

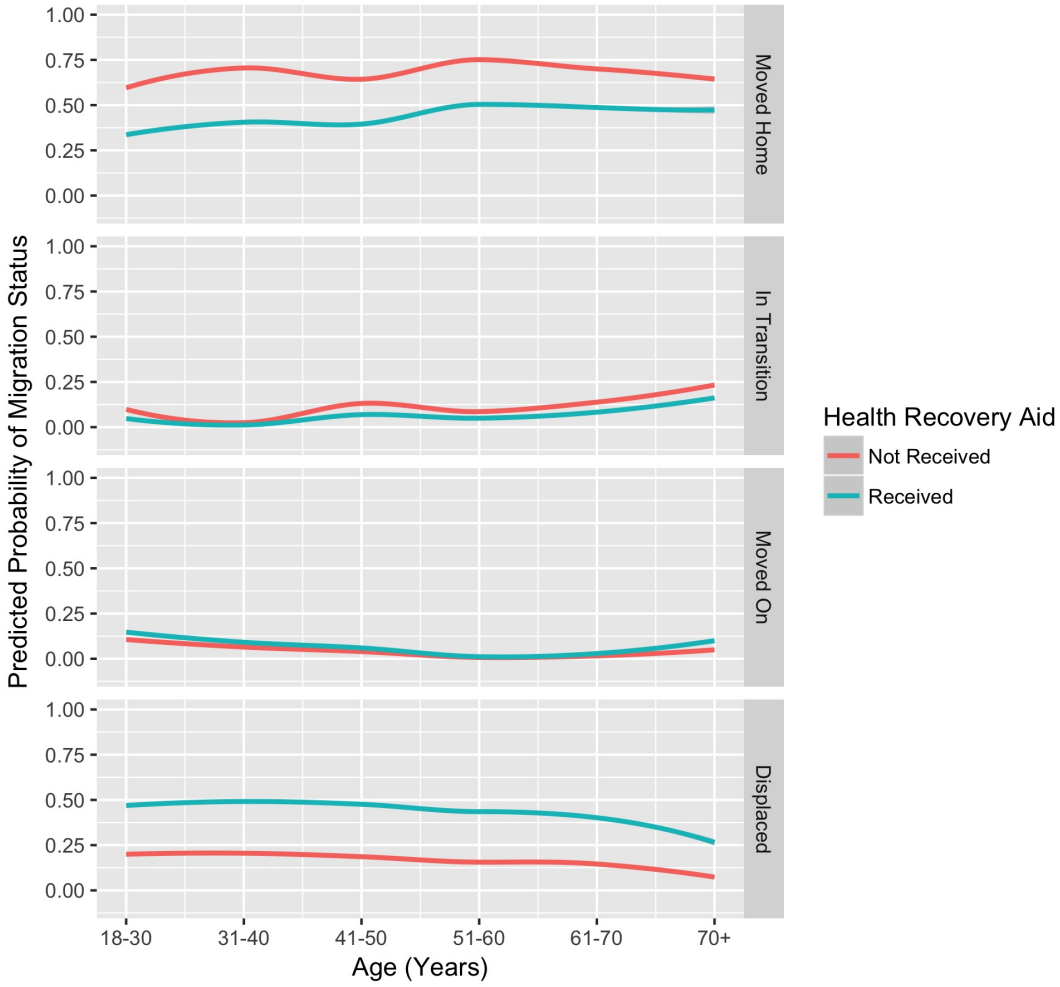

Figure 8. Predicted probabilities of *Migration Status* by *Health Recovery Aid*. Consistent with Figure 7, clear bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *Health Recovery Aid* associated with being *Displaced*. Minimal difference was seen for *In Transition* or *Moved On*. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts as well as factors often associated with migration in the contexts of disasters.

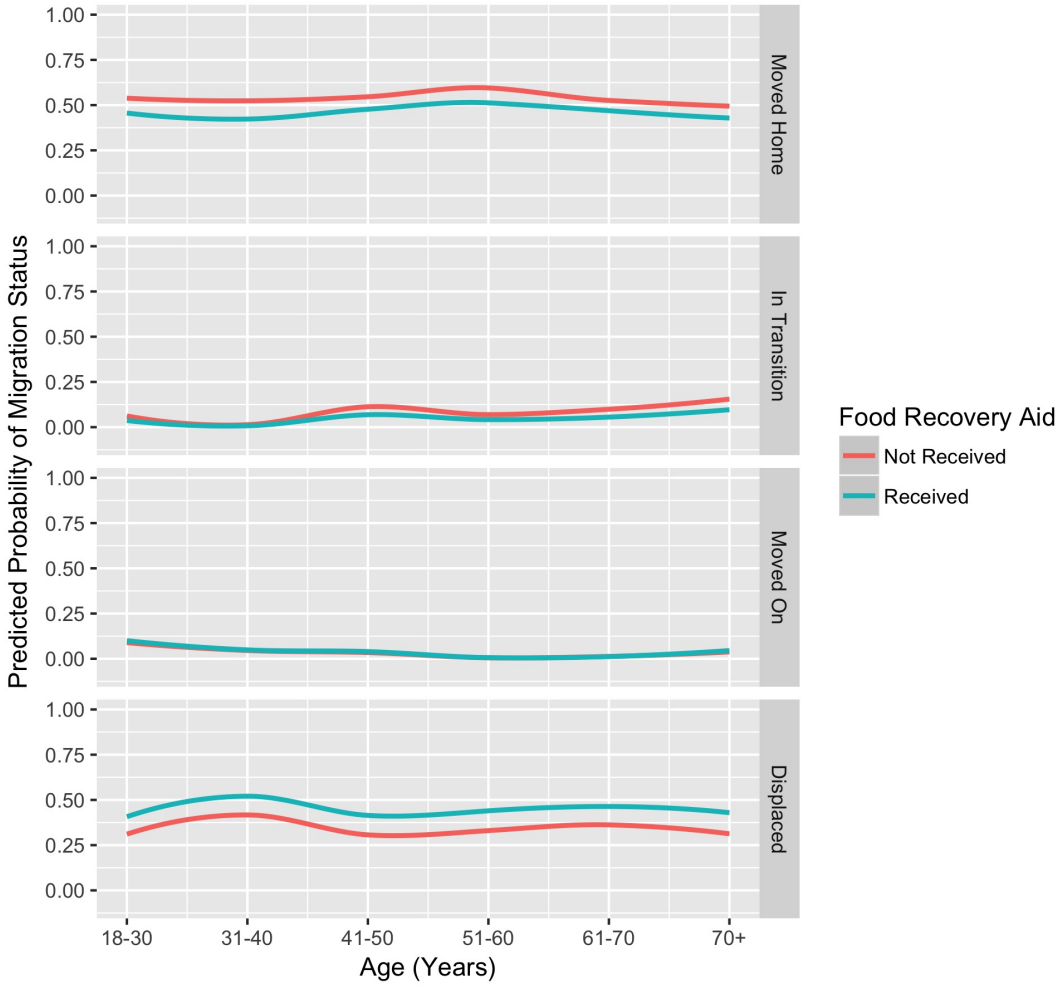

Figure 9. Predicted probabilities of *Migration Status* by *Food Recovery Aid*. Slight bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *Food Recovery Aid* associated with being *Displaced*. No discernible difference was seen for *In Transition* or *Moved On*. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts.

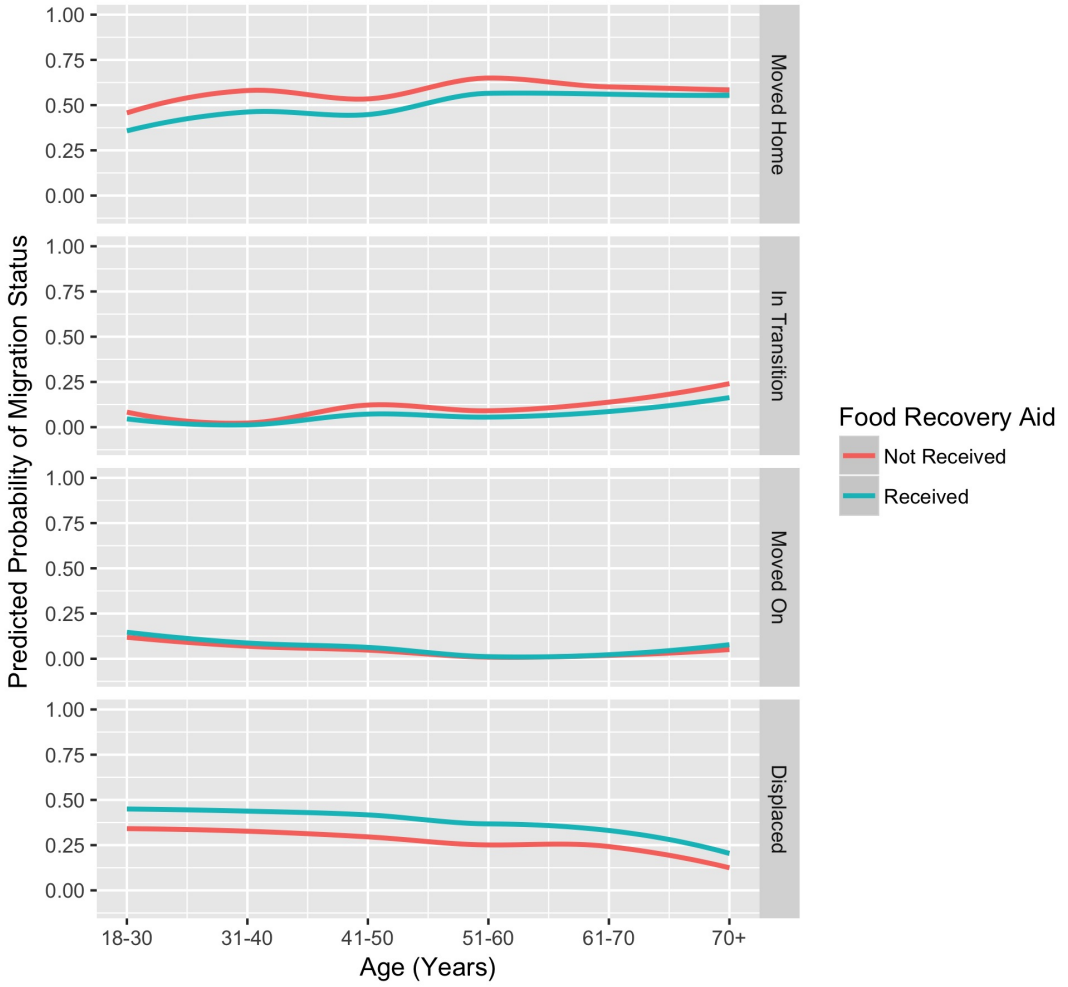

Figure 10. Predicted probabilities of *Migration Status* by *Food Recovery Aid*. Consistent with Figure 9, slight bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *Food Recovery Aid* associated with being *Displaced*. Minimal difference was seen for *In Transition* or *Moved On*. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts as well as factors often associated with migration in the contexts of disasters.

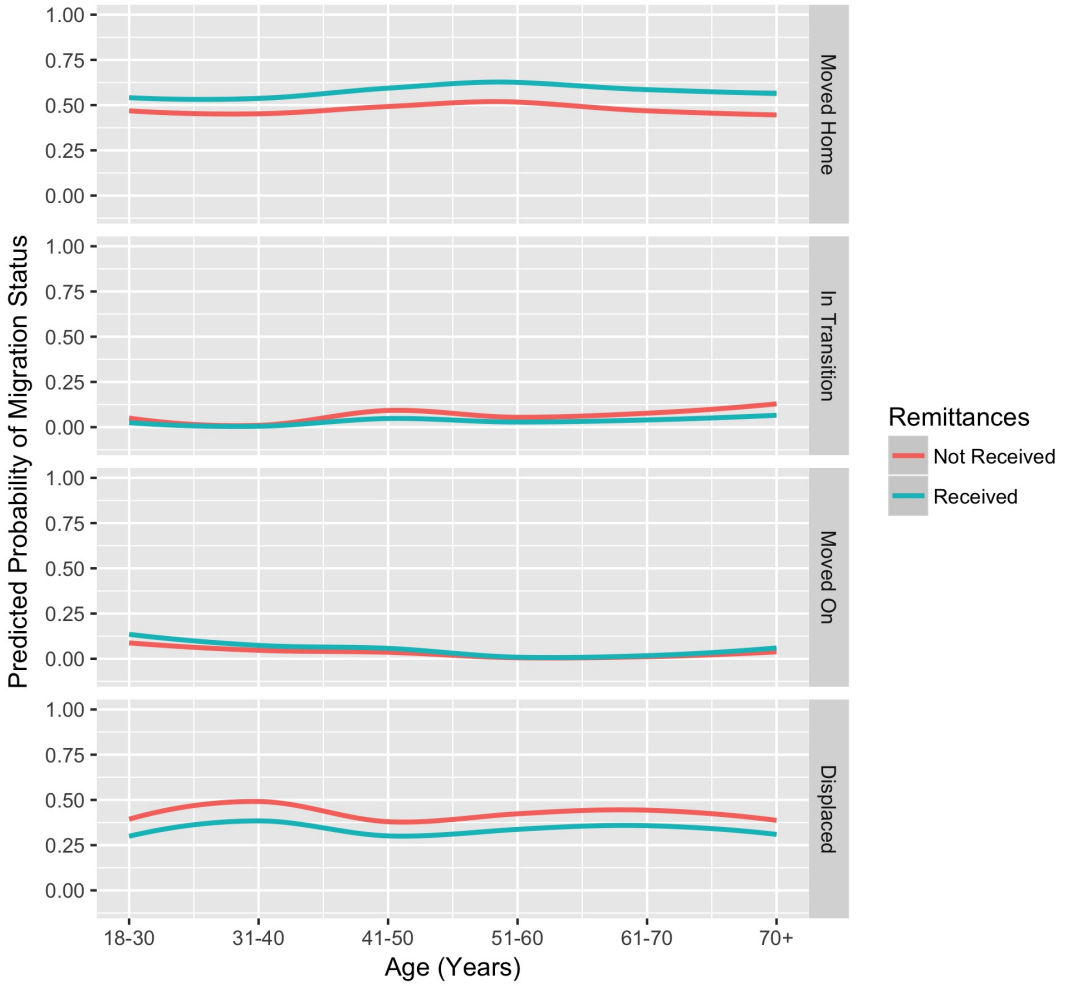

Figure 11. Predicted probabilities of *Migration Status* by *Remittances*. Slight bifurcations in predicted probabilities were seen for *Moved Home* and *Displaced*, with having received *Remittances* associated with having *Moved Home*. No discernible difference was seen for *In Transition* or *Moved On*. Predicted probabilities were estimated after adjusting for factors often associated with migration in general contexts.

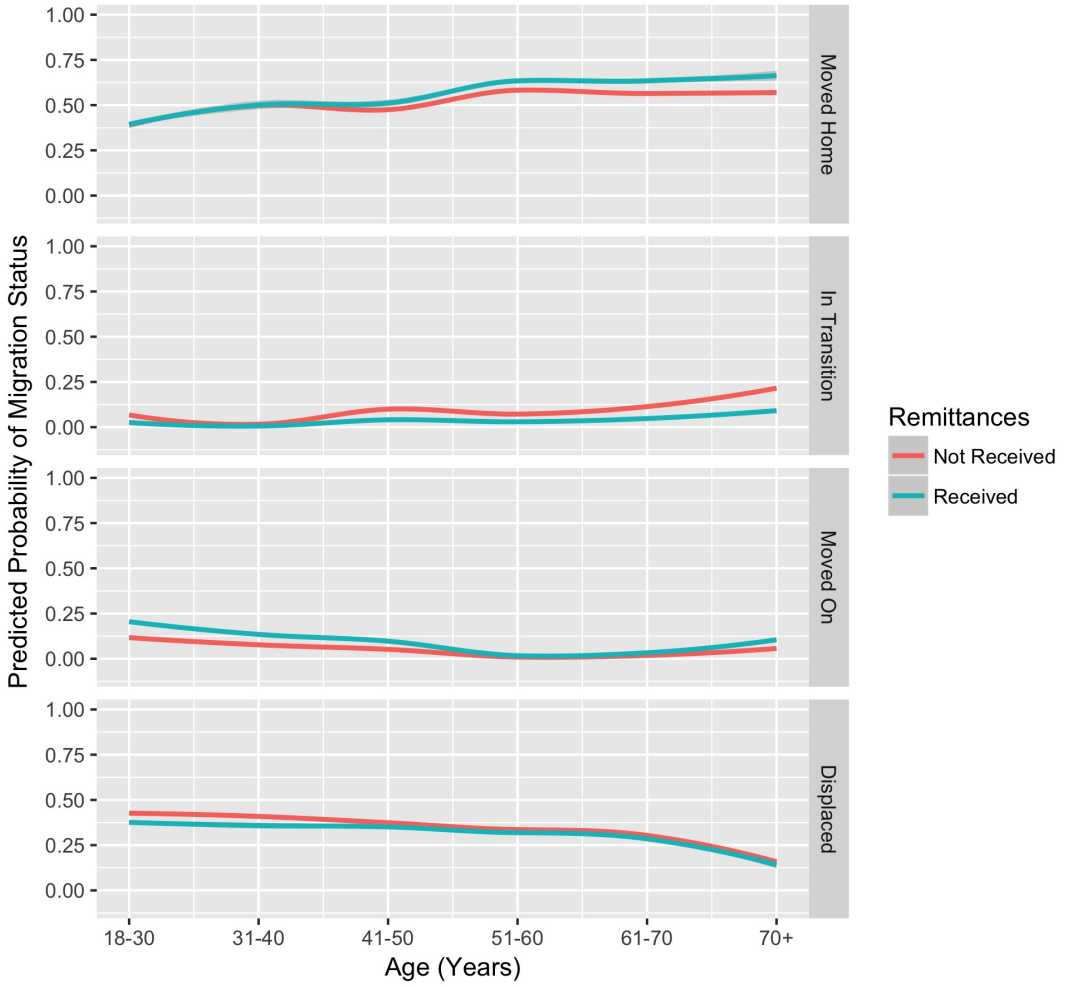

Figure 12. Predicted probabilities of *Migration Status* by *Remittances*. Bifurcations in predicted probabilities for *Moved Home* and *Displaced* converge after adjusting for factors often associated with migration in the contexts of disasters; however, having received *Remittances* was still associated with having *Moved Home*. Moreover, having received *Remittances* was also associated with a slight bifurcation in predicted probability for *Moved On* for younger age groups.

Appendix A

Table 1. Statistics for Comparing Sample to General Population

	Study Sample %	Special Region of Yogyakarta %	Indonesia %
Demographic Characteristics:			
Marital Status			
Single	3.5	32.6	31.9
Married	89.0	59.0	60.5
Divorced	2.0	1.4	1.8
Widowed	5.5	6.8	5.5
Religion			
Islam	92.2	92.0	87.2
Christian	7.5	7.5	9.8
Other	0.3	0.5	3.0
Education Attainment			
None	5.0	10.0	21.8
Some Primary	29.6	36.5	28.5
Lower Secondary	26.7	16.5	20.2
Upper Secondary and Beyond	38.7	37.0	29.5

Comparison data obtained from Indonesia's 2010 census (Statistik 2010), The marital status of the study sample is comparable to percentages reported for DI Yogyakarta and Indonesia overall in terms of divorced and widowed. The higher proportion of married compared to single is likely attributable to respondent status as head of household. In terms of religion, our study sample almost matches the population distribution DI Yogyakarta and is comparable to that for Indonesia overall. Our study sample has a somewhat higher distribution of educational attainment in comparison to the population of DI Yogyakarta, an areas that is known for having higher education attainment compared to national averages (Jones and Pratomo 2016). This differences is likely attributable to the age distributions in our sample as educational attainment in DI Yogyakarta decreases with age, so a younger sample in our data would result in somewhat elevated percentages for education attainment.

Note: Columns may not sum to 100% due to rounding.