Organization of Disaster Aid Delivery: Spending Your Donations

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Different organizational structures in the delivery of disaster aid result in significantly different qualities of hard aid, differential willingness to share aid delivery in a village, and differential promotion of public goods and maintenance of village traditions. We analyze three waves of survey data on fishermen and fishing villages in Aceh Indonesia, following the tsunami. Some well known international NGOs delivered housing with low rates of faults such as leaky roofs and cracked walls, but others did not. Some consistently delivered boats that were not seaworthy. Some pursued social agendas that were distorted by village leaders, resulting in increased inequality. (JEL code words: F35, H4, H5, H84, L2, L3)

I. Introduction

Extreme disasters catch the public eye, often resulting in massive infusions of aid that affect not just individual well being but the fabric of societies. We examine aid delivery in Aceh Indonesia, following the tsunami at the end of 2004. The tsunami devastated coastal villages in Aceh Indonesia, wiping out almost all physical capital and large proportions of the population. The international response was huge. For the affected areas, aid gave 134,000 houses for 120,000 houses destroyed (Xinhua News Service, February 1, 2009); and all forms of aid totaled 7.7 billion USD (Brookings, 2008), with aid officially completed in just over 4 years. How well such massive amounts of donated money are spent is something donors would like to know. NGO reports tend to focus on quantity in delivery—numbers of homes, numbers served—but not on quality. This paper attempts to unpack one key aspect of the aid black box: how the organization of aid chosen by NGOs directly and significantly impacts the quality of aid delivered and social objectives pursued. Apart from informing individual donors whether people, churches, or corporations about how well their money is spent, the analysis is critical to economists' understanding of the determinants of the efficacy of aid delivery.

The traditional aid literature focuses on the perspective of a generic donor country dealing with local recipients, asking how conditionality affects efficacy of delivery and how delivery affects village functioning. This paper takes a new perspective. Disaster relief projects involve multiple parties in different organizational configurations delivering in-kind aid, where each party has distinct objectives. Name brand international NGOs raise money from the public for general purposes and specific causes

such as alleviating the devastation from a particular natural disaster. These NGOs, along with foreign and domestic government agencies, then act as donor agencies funding aid delivery, or implementers on the ground in devastated areas. We examine how the way in which donors deliver aid through implementers has a profound impact on the quality of aid delivered and attainment of a variety of social objectives. While results will accord generally with what economists might expect a priori, this fundamental aspect has not been recognized in the literature.

To understand outcomes we model and analyze how implementers behave. We distinguish four organizational structures by implementation method: (1) *donor-implementers* who are NGO donors who do their own implementation in villages, (2) *international implementers* who represent different international donors who choose not to do their own implementation, (3) *domestic implementers* who represent different domestic or international donors who choose not to do their own implementation , and (4) an own country governmental organization, in this case *BRR* [Executing Agency for the Rehabilitation and Reconstruction of Aceh and Nias]. BRR was defined to be a short-lived implementer spending Indonesian government monies and monies from the multi-donor fund, typically governments of other countries and was disbanded in 2009 as planned. In most major disaster situations the own country appoints such an agency. While we focus on the method of implementation, the choice of implementation method yields information about donor agencies' preferences.

We analyze delivery of the main two types of hard aid in these coastal villages, houses and boats. We examine aid quality not quantity. Some NGOs may choose to fund bigger or smaller houses or more or less houses per extended family, choices we do look at. However, the main analysis concerns whether the houses or boats built are well constructed or not and the nature of NGO operations in villages.

Briefly, what in general do we find? We start with housing. We treat the domestic government agency, BRR, as the benchmark. It is the worst quality housing provider operating on a limited scale in many villages. BRR was as an implementer with little oversight by donor governments and no reputation to invest in. It had an aversion to operating in villages away from the provincial capital and its houses tend to have leaky roofs, cracked walls and poor foundations. In contrast, donor-implementers offer high quality aid. They are major NGOs with international reputations, where there is no principal-agent problem in aid delivery between donors and implementers. However donor-implementers often pursue social agendas in the villages in which they operate, which requires them to have a dominating presence in those villages. As such they tend to completely dominate housing provision in villages where they operate. When not successful in domination in a village, they appear to reduce aid quality according to the extent of deterioration of domination.

International implementers operate in an agency relationship with donors; but, despite the potential principal-agent problems, they tend also to offer high quality aid although their patterns are less

consistent. In contrast to donor-implementers, they do not shade quality when they are not the dominant provider. It seems their goal is just to provide good quality housing to all. They have international reputations to maintain with an eye to fund raising and being hired by other donors in the future. The largest international implementer in our sample is Habitat for Humanity (Indonesia), which in Aceh represented a consortium of donors including Mercy Corps, Plan International, and Fidelity Investment. Habitat for Humanity's well-known mission is to work with communities in building quality housing.

Domestic implementers are a heterogeneous group of some established agencies and those that arose only following the tsunami. They have no international reputation and many were short-lived presenting obvious principal-agent problems in aid delivery. Like BRR they typically provide poorly constructed houses. However, they are more knowledgeable than international agencies about local culture and better able to access local political and social networks. Their villages seem to have better non-housing outcomes than other implementer types, in terms of public good aid and preservation of village traditions, which may explain why some donors hire them despite their low quality housing.

For boats we have less information on implementer type. We use boats to illustrate two points. First concerns how substantial portions of aid can be not just low quality, but completely wasted. Second is how specific outside social agendas of NGOs can be thwarted or even perverted if the agenda is one village elites don't like. Overturning village socio-economic orders or conventions by agencies present for a short period of time seems simply unrealistic.

For housing, in analyzing the link between aid quality and organizational set-up, we interpret our results as implementer types causally affecting aid quality delivered in villages. The threat to identification of causal effects must involve both of two components. First is the common concern that there is matching, whereby an implementer is matched to a village with specific characteristics. The second component is that a village with the certain unobserved characteristics is able to induce better quality aid out of that implementer, compared to other villages. If so and if there was matching on these latter characteristics, part of our implementer-type effect would be influences of such characteristics. We argue the evidence suggests there is no threat to identification.

For the first component, apart from the identification question, it is interesting to know the extent to which there was matching on observables, whereby villages that have higher or lower levels of pre-tsunami social capital or that may seem more deserving because of lower rates of survival match to implementers delivering better quality aid. Aid delivery in Aceh obviously was not experimentally randomized across villages. Although there are randomized aid experiments involving monetary or in-kind allocations to individuals where implementation is strictly controlled, it is hard to imagine conducting randomized experiments in major disaster situations, especially on organizational structure of NGOs. Nonetheless, we believe that the allocation of implementer types across villages was largely

randomized in Aceh. Aid in Aceh was massive, immediate, and largely uncoordinated, in a region where foreign NGOs had no prior operations, regional maps of villages were highly inaccurate (Appendix 1), and centralized information on village characteristics almost non-existent. Which agencies ended up in which villages was a decentralized process with little effective oversight by BRR.

Our fieldwork suggests that in general after the tsunami, agencies showed up in villages guided by locals helping in the immediate post-tsunami clean-up process, offering to adopt those villages, and accepted on a first come first serve basis. Of course sometimes a village would accept an adopting agency and then the agency would not follow through. BRR did not start effective operation until more than six months after the tsunami and was little involved in this process. While later they offered information on which villages they thought were less served, their information was limited and it was 1-2 years before some major agencies detailed their operations to BRR (e.g. the Canadian Red Cross). A multinomial logit reported below indicates that the allocation of implementer types across villages was at most weakly related to a variety of village observed characteristics. Still one could imagine that NGOs with strong social agendas sorted through a set of villages looking for those which seem most receptive to their plans.

So the key to identification of causal effects must be the second component: whether village characteristics affect quality, conditional on implementer type. We find that all observable village characteristic variables including those of the village and very detailed sub-district fixed effects that control for local cultural, social, and political differences have absolutely no effect on aid quality. Of course no matter how many controls, there are always unobservables, where the biggest concern must be unobserved characteristics of the village head. Once aid is underway village leaders can monitor and may influence on-the-ground quality of delivery to some degree by being "squeaky wheels".

We don't think having meticulous and squeaky-wheel village heads at time of delivery is related to matching and hence is a threat to identification for two key contextual reasons. Village heads had no ex ante information about what types of agencies would deliver better or worse quality aid. Because of 20 years of insurgency and military occupation (settled in 2005), Aceh was an isolated province in Indonesia with no foreign and little domestic NGO presence prior to the tsunami. Not only did village heads have no prior information about aid agency quality, but there was no way post-tsunami for village heads to gather objective information on likely qualities of aid to be delivered by different agencies, or even on organizational and donor monitoring structure of delivery. Further, in most villages, the traditional village head chosen from village elites who was involved in the matching in 2005 did not survive the provincial reform of village democratization in early 2006, after the settlement of the conflict. Only 36% of the pre-tsunami village heads were still in office by 2007 and 12% by 2009. Most of these heads were removed from office in elections in 2006 and early 2007, where most aid was delivered in 2007. Thus, village

heads who negotiated aid contracts were typically no longer in office when most house construction was occurring (and if they were that has no affect on quality).

As far as we know, this is the first paper to analyze the micro behavior and implied objectives of different types of aid agencies operating in a major aid relief context. There is a large literature on the best ways to deliver aid concerned with local government response and manipulation, focusing on issues of conditionality (Collier et al. 1997, Azam and Laffont 2003, Svennson 2003, and Murrell 2002), strategic responses (the Samaritan's dilemma in Pederson 2001 and Torsvik 2005), co-ordination across agencies, village "ownership" of the process and the like (e.g., Kanbur and Sandler 1999, Easterly 2003, and Paul 2006). While agency issues are central to our analysis, here they are about agency problems among those donating and delivering aid. Unlike ODAs (Official Development Assistance) or planned NGO aid projects, disaster aid is mostly unconditional and largely uncoordinated as was the case in Aceh after the tsunami. In Aceh, lack of conditionality was driven in part by the huge number of NGOs "competing" to deliver aid. As an oversight agency, BRR, defined its role not as coordinating aid but as a clearing house recording aid and filling in ex post gaps in the process.

Empirically, the literature on large scale aid mostly utilizes country level aid data (Alesina and Dollar 2000, Burnside and Dollar 2000) or aspects of cross-country project data (Svensson 2003, Wane 2004), rather than micro-data. Wane (2004) does look at aid quality but focuses on the relationship between aid quality and a country's degree of accountability, rather than aid agency accountability. Our paper also relates to the economics literature on NGOs or not-for-profit firms, which focuses mostly on hospitals and schools and how those institutions perform and interact in the market (Newhouse 1970, Epple and Romano 1998, Malani et al., 2003). We add to this by examining humanitarian aid agencies.[1]

The next section describes how agencies are categorized and presents descriptive patterns by implementer type. Section 3 presents a model of aid agency behavior within villages. Section 4 analyzes house aid delivery and Sections 5 and 6 examine social agendas.

II. The context and descriptive patterns by implementer type

II.1 The context

We carried out extensive fieldwork in early 2005 after the tsunami and then again in 2007 and 2009, with teams in the field for a total of about 5 months, apart from the many months survey teams were in the field. We surveyed village heads and local heads of the fishermen's association (*Panglima Laot*) in those years and now cover 199 fishing villages, which are intended to be the universe of fishing villages in 31 sub-districts as one moves north (-east) and south from Banda Aceh, the capital (see Appendix 1). We also surveyed fishing families, now following a panel of about 635 fishing families in 90 of those

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[1] Also, there are studies that examine how the salience of disasters affects donation (Stromberg 2007) and how disasters affect household health, education, and risk management (Skoufias 2003, Townsend 1994).

villages. In addition, we have official government and international records. Relevant aspects of the surveys, a map and the main variables used are presented in the Data Appendix.

Being fishing villages, our villages were the most devastated by the tsunami, with almost all buildings, public works, boats and roads destroyed. Our villages account for about 30% of all house aid delivered in Aceh, with much of the balance delivered in Banda Aceh. Table 1 presents an overview of destruction in our villages, using official numbers on pre and post-tsunami populations and household counts to increase coverage.[2] Table 1 gives summary statistics for the 190 villages where we have complete information for both 2007 and 2009. Our survey counts of houses and public buildings pre and post-tsunami are fairly accurate since what was destroyed is recorded by the physical presence of remaining foundations, as well as village mapping exercises conducted soon after the tsunami. Boats are another matter since there is no written record of pre-tsunami boats nor physical evidence of what was destroyed. In 2007 villages tend to heavily exaggerate boats lost. We only report on villages surveyed in 2005, where we record boat, captain, and owner survival status.

Destruction is massive. In 104 villages around Banda Aceh surveyed in 2005, under 50% of the population survived; in the expanded set more survived as added villages experienced a weaker wave force. The destruction of physical capital in the overall sample is almost universal, given both the earthquake that created the tsunami and the wave following 20-30 minutes later. Mean survival rate of houses for the overall sample is 9% and that of public building is lower at 6%, noting that many public buildings such as mosques and fisherman halls are built on the waterfront. The survival rate of boats, based on 2005 survey numbers, is under 6%.

The immediacy and extent of aid are impressive. As Table 1 illustrates, 117% of "needed" houses were replaced by late 2007; need is the number of surviving households less the number of houses that survived. Similarly, for boats the ratio of boats in the water in 2007 to surviving captains recorded in 2005 is 105%. Finally, 80% of destroyed public buildings have been replaced by 2007 even with the significant drop in village populations. Overall the picture is that by late 2007, the massive aid process had accomplished what it intended—to replace the entire physical capital stock. Yet, given the massive aid there was money left to spend. More public buildings trickled in between 2007 and 2009, although almost no boats. For public buildings by late 2009 the replacement rate was 96%. House aid continued with an eventual replacement rate of 145% which was accompanied by new household formation or

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[2] We believe our survey numbers for 111 villages in 2005 are more accurate in portraying pre and post tsunami village populations than official numbers for reasons detailed in Freire, Henderson, and Kuncoro (2011). Official numbers seem to modestly undercount surviving populations. Survey numbers for the 88 added villages in 2007 on pre and post tsunami populations suffer from the fact that by then most village heads had been replaced and recollections on pre-tsunami numbers are noisy.

splintering of extended families, with each part of the family getting their own house. In modeling, this will motivate the notion of excess provision.

We note that aid agencies tend to specialize. Those providing public buildings, doing official mapping and planning, and providing boats tend to differ from house agencies. As we will see, in most villages one NGO provides the majority of housing. Public buildings were disproportionately provided by BRR — about 38% of 642 public buildings are from BRR (compared to 18% of houses). An Australian organization, APRID, built 51 of 121 new village halls and PLAN built 11 of 111 new health facilities. Neither provides housing. Nonetheless, housing NGOs exhibit the largest and by far most sustained presence in villages, often coordinating and influencing work by other NGOs, as discussed later.

II.2 Types of housing agencies and the allocation of implementer types to villages

Each village names the main aid agencies delivering housing and other forms of hard aid. For housing usually only 1 or 2 agencies are involved in a village, with occasionally there being a 3rd. We map each named agency into one of the four types of implementers, where typing is done based on information on donors and implementers in the "RAN" [Recovery Aceh-Nias] database,[3] a database set up by the Indonesian government working with the UN which recorded aid delivery aspects in Aceh. Details about this mapping are in the Appendix.

How did implementer types allocate across villages? Table 2 looks at the match between the housing implementer type and village characteristics. Since some villages have more than one housing aid project the number of observations is greater than the number of villages. We report the marginal effects from a multinomial logit regression, looking at the probability of a village getting a particular implementer type for a project, for each of the four types. There are 8 covariates we use, 5 of which depict internal village characteristics, 2 of which relate to village head characteristics, and the last being distance to Banda Aceh. Later we detail our choice of key covariates and the use of different types of fixed effects. To the covariates in Table 2 if we add 4 district (*kabupaten*) fixed effects, all 48 marginal effects (including those for fixed effects) are insignificant but one. However, district fixed effects mask a distance effect evident from Table 2: domestic agencies and BRR appear to have an aversion to operating in more remote locations. We don't see that as a match affecting our later aid quality results conditional on agency type. In fact if there was a bias in finding better quality for international agencies it would be downward, as distance may make quality more expensive. But the aversion (which was also clear from fieldwork) of domestic NGOs and BRR is of interest itself.

With respect to internal village characteristics, do villages with measured characteristics such as more devastation or higher levels of pre-tsunami social capital get agencies constructing better quality aid? Only one observed characteristic of those reported and the many tried had a statistically significant

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[3] http://rand.brr.go.id/RAND/

impact. Villages with a pre-tsunami *arisan* group are 19% more likely to get a donor-implementer and about 10% less likely to get an international implementer or domestic implementer. As explained later *arisan* groups are rotating saving and credit associations (RoSCA). It could be that villages with *arisan* groups have environments of greater social capital appealing to donor-implementers. While we have weak evidence of matching on observables, matching is a threat to causality if village unobserved matching characteristics influence the same agency to give better quality aid in villages with those characteristics, compared to those without, an issue analyzed later.

II.3 Housing aid and quality

The raw data indicate that the four types of implementers operated differently and delivered different qualities of aid. We start with operations. Table 3 compares the scale of housing aid operation by implementer type across the 199 villages, with individual numbers for the 8 largest housing providers in our sample. Each village has 1 to 3 housing projects led by different agencies. Table 3 reports some numbers at the project level and some at the village level. The table shows that house aid tends to be given mostly by one agency in any village. [4] Apart from the table, only 14% of implementer projects involve a third project in a village; and, in 46% of villages, over 90% of housing comes from one agency.

BRR is the largest single provider and is involved in many villages with a small number of houses per village. It has a relatively high fraction of occurrences where its provision is minimal (under 15% of total house aid), and a small fraction where it is the almost sole provider (over 90%). Donor-implementers provide a sharp contrast. Their provision is much more focused: they are sole providers in a high fraction of villages and are minimal providers in only a few villages they are present in. Overall, donor-implementers are dominant [almost sole] providers in 80% [43%] of villages where they are present, compared to 45% [16%] for domestic implementers, 34% [14%] for international implementers and 34% [17%] for BRR. The Canadian and British Red Cross's stand out as dominant providers; the Canadian Red Cross is the sole provider in 8 of its 11 villages. Domestic implementers compared to international implementers have a greater relative presence in villages, with somewhat more houses per village and modestly greater likelihood of being the dominant agency. Domestic implementers are potentially a more diverse group; we identified 28 different domestic implementers delivering housing in our villages compared to 12 international ones.

How does house aid quality differ by implementer type? We report on two rankings. First for each housing aid project, the village head was asked to rate the quality of construction in terms of the likelihood of "leaky roofs, cracked walls, faulty plumbing, and mould" with 3 categories: (i) high (all houses well built) (ii) medium (some well built and some not) and (iii) low (most not). A high rating is a

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[4] While BRR is a specific agency, other numbers are for group types. For group-types, different agencies of the same type may appear in the same village. For example, if two different donor-implementers appear in a village, although that is just one village where any donor-implementer appears, it counts as two donor-implementer projects.

3, medium 2, and low 1. In the survey, we distinguished early and later batches for each agency. Ratings are generally the same for both batches, but if not we average the ratings, so for each project our scale can be 1, 1.5, 2, 2.5, or 3. For each type of implementer we calculate the average ranking over all projects. We believe village heads tend to give high ratings (given they are involved in the process); and the measure is coarse. Second, individual fisherman list house faults: leaky roof, cracked walls, poor foundation, or faulty plumbing, so each fisherman can list 0-4 faults in his house. We average across fishing families served by each type of implementer to obtain another ranking by average number of faults.

Figure 1 shows these two rankings. While the averages are not significantly different, they point to patterns that in econometric work will be significant. BRR is the worst ranked by both village heads and individual fishermen. Donor-implementers offer the highest quality housing as rated by village heads, and correspondingly have the fewest counts of faults as reported by fishermen, reflecting what we believe to be their greater ability to deal with moral hazard issues. For international implementers the evidence is more mixed. Village level data suggests they have a relatively good record for house quality construction, but the averaged fisherman data suggest their number of faults is the same as domestic implementers. In the econometric results international implementers will score better than domestic ones as rated by fishermen but only weakly so.

Table 4 gives detailed data on housing quality of individual agencies providing housing in our villages. We list all agencies that operate in two or more villages; many are well known agencies. Those who operate in only one village are listed in Appendix 2. For lead implementers the table gives number of houses provided, number of villages involved, and average ratings by the village head. For international and domestic implementers, we list in brackets the donor agencies often associated with the implementing agency. Some village heads report the funding agency but not the domestic-implementer working on the ground. In this case, we list the funding agency associated with the anonymous domestic implementer. For the smaller set of villages where fishermen report in the sample, we list the average count of faults associated with the relevant implementer.

For village heads, we think an average rating near or below 2.5 isn't good and ratings at 2 or below are bad. Clearly, most domestic implementers as well as BRR have relatively low village head ratings and higher counts of faults, but some international agencies do as well. For counts of faults, there is a sharp divide with international agencies scoring below 1 and domestic ones over 1 in general.

II.4 Boat quality

An aspect of aid outcomes is the high failure rate of boats. There are two dimensions to failure. The first reported in village level data by the local head of the fishermen's association (*Panglima Laot*) concerns immediate failure: many boats were too light-weight or improperly designed for use on the open ocean, sank upon first launching due to bad design, or fell apart after a few outings. By 2007 just after most

boats had been given, the overall abandonment rate as reported at the village level was already 22%. Many boats clearly unusable for fishing at time of delivery are not reported in the individual fishermen data. The second dimension to failure is boats that were initially usable but fell apart after a few months of usage, in a context where minimum boat life for a traditional boat is 5 years. We estimate that by 2009 at least 30-40% of boats had failed either initially or in the subsequent 2 years.

From that village level data as reported in 2007, Table 5 provides a list of individual agencies operating in 2 or more villages with Appendix 2 listing those operating in just one village. The table gives the number of boats in aid, villages, and the initial failure rate. We cannot identify comprehensively implementer type for boats, because most boat aid is not reported in the RAN database. Later we will utilize the few NGOs that can be typed as boat donor-implementers in the empirical work. As such, implementer type is not the focus in our analysis of boat aid, but rather a particular social agenda discussed below. Still it is instructive to see the failure rates by agency. NGOs like Oxfam, International Medical Corps, and certain foreign governments like France, Kuwait, and the Japan International Cooperation Agency have appalling records of reported boat failure.

II.5 Socio-economic agendas

Today, agencies delivering hard aid tend to have also an objective of "sustainable development". This is reflected in mission statements on NGO websites that talk about (italics added) "*sustainable* development", "*long term* rehabilitation", "continue to stay long after the emergency is over, working with communities to *rebuild their lives*…", or "help restore and *strengthen* their pre-disaster *capacities*".[5] However in some cases lurking behind these code-words are socio-political-religious agendas that are intended to influence village way of life and social institutions. These are reflected in statements (italics added) about having "decent communities in which people…can grow into all that *God intended*"[6] and "addressing *structural causes of poverty and related injustice*"[7].

Some international agencies that arrived in Aceh in 2005 planned to implement social agendas, through "adoption" of specific villages whereby they would provide all aid in the village. As an example, in early June 2005 we interviewed British Red Cross officials in Banda Aceh, who were operating an intensive training program for their field workers. They were planning for their then four adopted and remote fishing villages. Apart from planning delivery of hard aid, they articulated goals of modernization and social reform. Modernization involved community planning, registering all lands for formal title,

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[5] The respective websites for these quotes are
http://www.wvi.org/wvi/wviweb.nsf/maindocs/7A0A54FD44BC11C38825737500737C8A?opendocument ,
http://www.gitec-consult.com/TheCompany.htm, http://www.redcross.ca/article.asp?id=11724&tid=001,
http://www.redcross.org.uk/What-we-do/Emergency-response/International-emergency-response, and
http://crs.org/emergency.
[6] http://www.crwrc.org/pages/crwrc_international relief.cfm.
[7] http://www.oxfam.org/en/about/what/mission.

requiring villagers to carry retinal scan ID's (despite a lack of use for such ID's) and learning how to operate ATM's despite the local absence of bank accounts or ATM's. On social reform, one intention was to provide just enough money to villagers so that they could only acquire a motorized boat through joint ownership, as opposed to the traditional form of sole ownership with crew. They wanted villagers to formally contract with potential partners and for all boats to be jointly owned. More generally, adoption in 2005 was also very much in the vocabulary of village heads. Two years later the idea of strict adoption was muted. Given the massive relief effort, by 2007 villages faced many alternative donors. Delivery of aid had become specialized as noted above, with different NGOs delivering different kinds of hard aid. However, housing aid agencies were necessarily involved in village planning (lay-out, road access, water delivery, etc.) and had a sustained presence in the village during construction. With such a presence in villages, housing aid agencies could still pursue certain social agendas for specific villages.

A specific socio-economic agenda concerns boats, with the imposition of shared ownership. For the boats which are reported in 2009 in the individual fishermen questionnaires as having been received on aid in prior years, Figure 2 illustrates the agenda of shared ownership and boat aid quality. For the 44% of boats given which had initial shared ownership, failure rates are much higher than for non-shared boats (53% vs. 16%); and, regardless of failure, joint ownership fails to persist with only 20% still sharing in 2009. Of course the high failure rate plays into that. But among surviving boats that were initially shared, only 35% still had shared ownership in 2009. While high failure of shared boats could occur because NGOs emphasizing shared ownership generally gave bad quality boats, econometrically we will find a key strategic reaction by villages. In the presence of within agency heterogeneity in boat quality, poor quality boats were steered by village and lagoon fishing leaders towards those upon whom shared ownership was imposed, often lower status fishermen. Presumably, this was not what donors intended.

III. Modeling agency behavior

In this section we present a stylized model of implementer and village head behavior, to inform how we think about key aspects of the problem. In each village in line with basic patterns in the data, we assume there is a lead agency which provides the vast majority of house aid in the village and that we are in a region of parameter space where this agency provides at least as much as is "needed" (to house all surviving families). There is also a residual agency that may give "excess" houses in villages. The model does not allow for a third type of agency in a village but that is unusual in the data. The notion of excess is motivated by the fact stated earlier that, by 2009, villages had been supplied 145% of "needed" housing. Contextually in Aceh, we think of the residual agency as being BRR, which, as illustrated in Table 4, operated at a low level in many villages, with low quality housing. In reality, the "residual" agency was not always BRR; and the quality of residual housing can be high. Some international implementers were a residual, late-in-the game provider, while others were lead providers.

We analyze lead agency behavior, relative to how we type-cast BRR in the model. While principal-agent and reputational issues arise, for simplicity, we do not explicitly model the principal-agent or reputational problems per se, but specify a reduced form which accounts for these influences.

III.1 Preferences and costs of aid agencies

The lead agency derives utility from two components: house aid provided to the village and socio-political activities. Socio-political activities generate benefits

$$A e_1^\delta \left(\frac{\overline{n} + \Delta}{\overline{n} + \Delta + n_0} \right)^\theta .$$

The value and nature of A may differ by agency type and may be zero. Effort devoted to social activities is e_1, subject to diminishing returns, or $0 < \delta < 1$. Social-political benefits are a function of the degree of the lead agency's domination of housing aid in the village.

In the above expression, we assume there is a count of needed houses, $\overline{n}$, in each village. Needed houses are the number of surviving families with houses destroyed which is documentable by the inspection of slab foundations. $\overline{n}$ is supplied by the main agency. After that, there are two potential sources of excess: Δ units provided by the lead agency and n_0 by the residual provider. Those numbers are determined jointly through decisions made by the village head and lead agency and may result in either a solution where both the lead agency and residual provider operate in the village, or a corner solution where the lead agency acts strategically to exclude the residual provider. The value of social agendas is non-decreasing in the degree to which the lead agency dominates all housing provision in the village, or the higher $(\overline{n} + \Delta) / (\overline{n} + \Delta + n_0)$ is. For example, village health conditions may be related to the fraction of houses supplied with piped water; or proselytizing success may depend on the fraction of households where there is direct contact. The relative value of control is increasing in θ, $0 \leq \theta$.

The lead agency's benefit in providing house aid is defined by both per house quality q and the number provided. Quality of aid q is determined by the effort put into providing each house, e_2, and is subject to diminishing returns, so $q = B e_2^\alpha$, $0 < \alpha < 1$. The lead agency's total benefit from housing can be expressed as $B e_2^\alpha (\overline{n} + \Delta^z)$, $0 < z \leq 1$, where agencies may perceive less benefit from excess houses. For simplicity, we assume all houses in a village from the same agency are of the same quality; in the data earlier or later batches of houses from the same agency do not differ significantly in quality. Higher values of B could be interpreted indicating fewer principal agent problems or stronger reputational considerations. In short, lower B means less value to the agent in providing higher quality.

On the cost side, there is a fixed cost, C, to entering and operating in the village. Aid agency workers involved in the village, e_1, are paid a wage w_1, while housing construction effort e_2 is paid at a

rate w_2. Later to give more of a monitoring flavor, we allow employment of agency workers, e_1, to reduce the cost of quality. In sum, the lead agency seeks to maximize its total benefit, U, in the village

$$U = Ae_1^\delta (\frac{\bar{n} + \Delta}{\bar{n} + \Delta + n_0})^\theta + Be_2^\alpha (\bar{n} + \Delta^z) - [C + w_1 e_1 + w_2 e_2 (\bar{n} + \Delta)] \qquad (1).$$

Determining the extent of the agency's housing provision has two parts. One concerns the residual provider and the other the village head's optimization. We assume residual housing involves no fixed cost nor socio-religious-political agenda, We assume such agencies don't care about oversupply and their $z = 1, A = 0$ and that, in this context, $e_1 = 0$. They provide a house of minimum quality level $\underline{q} = B\underline{e}_2^\alpha$ where $\underline{e}_2$ is given by the FOC $\alpha B\underline{e}_2^{\alpha-1} = w_2$.

III.2 Village head's problem

The village head sees benefits of getting more houses and the benefit depends on quality. However, as the number of houses rises above $\bar{n}$, he perceives a social cost to splitting the traditional extended family across houses — in particular moving unmarried adult children out, moving elderly parents out, separating wives (if multiple wives), moving daughters and married husbands out, and the like. And if there are in-migrants (tsunami refugees), these extra houses may be valued less. He may also see a cost to socio-political agendas of agencies, but we ignore that for no loss of generality.[8] Assuming the lead agency provides at least $\bar{n}$, the village head seeks to maximize

$$Be_2^\alpha (\bar{n} + \Delta) + \underline{q} n_0 - (\Delta + n_0)^\gamma, \quad \gamma > 1, \qquad (2)$$

where the village head can limit the amount of housing provided by any agency. Assuming simultaneous choices of e_1, e_2, and Δ by the lead agency and n_0 by the village head, the village head limits n_0 so that the marginal utility from n_0 is non-negative, i.e., $\underline{q} - \gamma(\Delta + n_0)^{\gamma-1} \geq 0$. Knowing this, the lead agency sees

$$n_0 = (\underline{q} / \gamma)^{1/(\gamma-1)} - \Delta. \qquad (3)$$

If it chooses, the lead agency can set $\Delta = (\underline{q} / \gamma)^{1/(\gamma-1)}$, so the village head sets $n_0 = 0$ and the agency becomes the exclusive provider in the village. [Note that the village head only chooses to limit n_0, not Δ.

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[8] Including it would reduce the village head's aversion to excess housing (so as to dilute social agenda benefits for the lead agency) and raise the bar for the lead agency to act to strategically exclude the residual provider.

At $n_0 = 0$, the village head would like greater than Δ of extra housing from the lead agency where we restrict parameters so that in equilibrium $Be_2^\alpha > \underline{q}$. [9]]

In summary for the agency's maximization problem, (3) is substituted into (1) to get

$$U = Ae_1^\delta \left(\frac{\overline{n} + \Delta}{\overline{n} + (\underline{q}/\gamma)^{1/(\gamma-1)}}\right)^\theta + Be_2^\alpha(\overline{n} + \Delta^z) - [C + w_1 e_1 + w_2 e_2(\overline{n} + \Delta)] \qquad (4)$$

III.3 Aid agency choices

If a lead agency has no social agenda and hence $e_1 = 0$, it can be shown it will only provide excess housing if $z/\alpha > 1$. The full problem is more complicated with FOC's $\partial U / \partial e_1$, $\partial U / \partial e_2 = 0$. For choices of e_1, e_2 that satisfy these equations at the relevant Δ, we note 3 types of solutions:

(1) Corner at $\overline{n}$ ($\Delta = 0$): $\partial U / \partial \Delta \big|_{\Delta=1} < 0$, $\partial U / \partial \overline{n} \big|_{\Delta=0} > 0$

(2) Interior: $\partial U / \partial \Delta = 0$, $0 < \Delta < (\underline{q}/\gamma)^{1/(\gamma-1)}$ $\qquad$ (5)

(3) Corner at $\Delta = (\underline{q}/\gamma)^{1/(\gamma-1)}$: $\partial U / \partial \Delta \big|_{\Delta \to (\underline{q}/\gamma)^{1/(\gamma-1)}} > 0$, $\partial U / \partial \Delta \big|_{\Delta=(\underline{q}/\gamma)^{1/(\gamma-1)}} < 0$.

At the first corner, the lead agency allows the residual provider to give all housing beyond $\overline{n}$. At the other corner the lead agency strategically crowds out the residual provider but stops just at the Δ sufficient to do that.[10] Case 2 is the interior solution between the two corners, where the lead agency shares excess housing provision with the residual provider.

The model does not lend itself to closed form solutions. While in principle one can differentiate to do comparative statics, the model has problems of corners and non-existence. To illustrate comparative static forces based on what are feasible (equilibrium) outcomes as opposed to infeasible ones, we do simulations. Before identifying stereo-type agencies, we give some intuition. As explained above, we expect agencies with higher B's to provide higher quality housing. Agencies with higher values of z have less aversion to oversupply, meaning the lead agency has less loss of benefits with over-provision done to retain village "control". They also have a smaller rate of decline in benefits to quality in the

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[9] Also, we restrict the parameter space so that the lead agency's marginal net benefit of supplying more housing is negative for $\Delta > (\underline{q}/\gamma)^{1/(\gamma-1)}$. An alternative would be to have the lead agency want to provide more housing than $(\underline{q}/\gamma)^{1/(\gamma-1)}$ with a limit potentially being set by the village head.

[10] An alternative to case (3) being a corner would be to allow the region of parameter where the lead agency is willing to provide beyond $(\underline{q}/\gamma)^{1/(\gamma-1)}$. If so, there could be an interior solution before $\Delta_{max} = (Be_2^\alpha/\gamma)^{1/(\gamma-1)}$, or the village head could set that upper limit.

expression $Be_2^\alpha(\bar{n}+\Delta^z)$ as scale rises. Correspondingly, agencies with higher values of θ place greater weight on not admitting a residual provider, given shared provision reduces social agenda benefits.

Characterizing implementer types. To illustrate comparative statics, we fix parameters: $\bar{n}=100, w_1=2, w_2=1,\ A=17,\ \underline{q}=40,\ \gamma=2,\ \alpha=.5$ and $\delta=.6$. Outcomes are very sensitive to z, so we start by fixing $z=.8$. We focus first on what happens as we vary $B,$ the value of house quality, and θ the value of dominating supply for social purposes. Table 6 presents a caricature classification of our four types of agencies based on earlier discussion and later outcomes in the data. BRR, the residual provider, has no social agenda ($A=\theta=0$), does not care about oversupply of housing ($z=1$), and offers a basic low quality house of 40. The table gives the value $B=8.94$ consistent with this quality level coming from optimizing behavior by BRR. For this BRR quality, village heads want at most 20 additional houses beyond their basic needs $(\bar{n}=100)$.

In comparison to BRR, donor-implementers have high housing value ($B = 12$), a social agenda, and a strong desire to have full control in the village $(\theta=.9)$. They offer high housing quality and have almost complete control of the village: 119.5 out of 120 "houses" (ignoring issues of fractions). International implementers also highly value housing quality ($B = 12$), but don't care so much about dominating provision ($\theta=.2$). Thus they offer fewer houses: 114.4 of 120. Note their quality level is slightly higher than donor-implementers; this occurs because they are supplying fewer excess houses and so perceive higher marginal quality benefits. Also their social effort is less. We note that modest reductions in z in these examples result in big supply reductions as additional houses have low value; for example Δ falls rapidly to 0 as we lower z from .8 to .7. Finally, we caricature domestic implementers as having low house quality value like BRR ($B=10$), but having a social agenda where they want some degree of control ($\theta=.6$). Thus, their house quality is near BRR but like donor-implementers they supply almost the whole village, 119.2 out of 120, and they have high social effort.

Corner solutions. In Table 6 all examples involve interior solutions where $0<\Delta<20$. An example satisfying a corner where $\Delta=20$ and condition 3 is met in equation (5) occurs for $B=12, z=.8,$ and $\theta=.95$. That is, for a donor-implementer a slight rise in θ leads to domination in Table 6. What happens as we decrease the village head's aversion to extra housing by lowering γ? If we are at this corner with domination, lowering γ can move the solution back into sharing, with increased overall housing provision. This heterogeneity in village preferences will play a role in the empirical work and in the next paragraph. For the other corner, condition 2 in equation (5) is satisfied for $B=10, \theta=.6$ and $z=.4$, achieved by have greater diminishing returns to extra housing (lower z).

<u>How quality can decline as domination declines.</u> In the model, as a lead agency increases domination and house supply beyond what is needed, it lowers overall quality. However in the data the quality of housing provided by donor-implementers rises as their domination rises. Two adjustments to the model can account for this. First as just noted is heterogeneity in village preferences for extra houses from varying γ in $(\underline{q}/\gamma)^{1/(\gamma-1)}$. Second is use of social agenda labor, e_1, to improve housing quality, implicitly allowing monitoring of contractors by this labor. More agency workers, e_1, make the realization of a given quality level cheaper, or reduce the cost of employing construction workers. A simple version defines the true cost of a construction worker as $w_2 - re_1 (> 0)$, with a new objective function

$$ U = Ae_1^{\delta}(\frac{\overline{n}+\Delta}{\overline{n}+\Delta+n_0})^{\theta} + Be_2^{\alpha}(\overline{n}+\Delta^z) - [C + w_1e_1 + (w_2 - re_1)e_2(\overline{n}+\Delta)]. \tag{6} $$

We then re-solve the model for $B=12$, $z=.8$, and $\theta=.5$, with $r=.0002$. Then as γ declines and excess housing rises from 20, not surprisingly, the lead agency's share of total housing declines. But its per house quality also declines. As share declines there is less incentive to invest in social agendas and thus to monitor for better quality. We note that there are regions of parameter space where quality rises with the permitted excess and others where the relationship is non-monotonic. Appendix 3 depicts cases of this relationship based on different values of *r*.

III.4 Donor choice of implementers

The model analyzes the preferences and actions of implementers. As such it captures the same for donor-implementers. However, in cases where donors choose international implementers, domestic implementers, or BRR, what can we say about donor preferences and choices? For donors who hire international implementers, we presume their focus is on housing quality and not much on effects of aid on village way of life. To get better quality housing than residual provision, they hire good reputation international implementers. It is possible that these donors have socio-religious-political agendas, but to set up their own operations in Aceh to pursue such agendas could be too expensive for them. Local or international donors may hire domestic implementers because these donors perceive domestic implementers to be more knowledgeable and respectful of local traditions, and better aware of village needs beyond housing. Such donors could also have socio-political beliefs about employing local agencies (institution building), even if they realize that could result in lower quality provision. Finally, donors who chose BRR were typically foreign governments and international consortiums, whose long term reputational concerns about aid quality may be low. "Cynically" they may only want to announce to their public that they gave so much money or built so many houses, with less regard for quality.

IV. Empirical Evidence on the Quality of Housing Aid

In this section we estimate how aid quality differs across implementer types. We examine how the degree of agency dominance within the village affects quality. We look at outcomes from both village level data and individual fishing family data.

IV.1 Base specification and covariates

We have two base specifications. First is

$$y_{pv} = c + \sum_t \beta_t D_{tpv} + \gamma X_v + \Lambda_k + \varepsilon_{pv}, \qquad (7)$$

where y_{pv} is the quality measure for housing aid project p in village v as reported by the village head, or by fishermen for their specific house provided under project p. For the quality measure, we look at village heads' subjective assessments based on construction quality, fishermen's subjective assessments of problems related to construction, as well as their report of quantity as measured by additional rooms in their houses. D_{tpv} are indicators for whether the village project was implemented by type t implementer, that is, donor-implementer, international implementer, or domestic implementer. BRR serves as the base type. Λ_k is a set of district or sub-district fixed effects we discuss in detail momentarily. We are primarily interested in β_t and expect donor-implementers and international implementers to have larger coefficient estimates than domestic providers.

The second specification further distinguishes whether a project is the dominant project in a village or the 2nd or 3rd order project by the number of houses given in aid. This order in general corresponds to the order of aid delivery as well: biggest projects are for the earliest donor. The specification with project order is

$$y_{pv} = c + \sum_t \sum_r \beta_{tr} D_{tpv} \cdot r_{pv} + \gamma X_v + \Lambda_k + \varepsilon_{pv}, \qquad (8)$$

where r_{pv} is an indicator for project order which can go from 1 to 3. Here we are interested in whether some implementer types shade quality for 2nd and 3rd order projects.

In both specifications, $\mathbf{X}_v$ are a vector of village level covariates. Throughout the paper, we use a common set of covariates for base village characteristics, representing village demographics (number of post tsunami households, population survival rate), distance from Banda Aceh, amount of physical capital destroyed, and pre-tsunami social capital. These are characteristics which from other work affect outcomes to do with volunteerism and labor market choices in our villages (Friere, Henderson, and Kuncoro, 2011 and Nose, 2011). We eliminate 8 villages with missing or very bad population numbers, 5 with missing numbers on houses destroyed, and 7 with other missing data (e.g., GPS readings to calculate

distance to Banda Aceh or aspects of social capital).[11] When we analyze individual fishermen's assessments, we will add family controls as well. Standard errors are always clustered at the village level.

The village covariates include two direct social capital measures. The first is the pre-tsunami existence of *arisan* groups, or rotating savings and credit associations [RoSCA]. Such groups of women meet regularly, with each member contributing a fixed sum to a pot and then taking the pot on a rotating schedule. An *arisan* group is a volunteer association outside the mosque and governance structure. While the theoretical work (Besley, Coate, and Loury, 1994) suggests RoSCA's alleviate credit market imperfections, empirical work finds a strong social component to *arisan* groups (Varadharajan, 2004). The other is whether the mullah, the spiritual leader of the village, survived the tsunami or not, providing continuity in village spiritual leadership. A companion paper, Freire, Henderson and Kuncoro (2011), finds that village traditions of volunteer labor are better maintained in the 68% of our villages which had *arisan* groups pre-tsunami. That paper also finds that mullah survival is important in maintaining village traditions of volunteer labor; but that survival of village heads is not, given few heads remain in office even two years after the tsunami. We view villages with pre-existing *arisan* groups as having higher social capital and spirit of mutual assistance and villages with surviving mullahs as being more resistant to external interventions (spiritual pollution) in village affairs. We also note that village size and survival rates may affect social cohesion.

For fixed effects, we do not include village fixed effects, because these eliminate effective variation in implementer types, given so many villages have just one provider and many agencies operate almost exclusively at one level or another. A basic control for cultural-institutional differences across sets of villages is fixed effects for the 4 districts in our sample and we use this throughout. In principle a better control would be fixed effects for the 31 sub-districts (*kecematen)* for the 179 villages in the main estimating sample. This is a tight control, since sub-districts on the coast are small geographic areas of several neighboring villages usually with common geographic and social characteristics. In particular, they closely mimic lagoon divisions, where fishing activities are governed informally at the lagoon level. For our main result with its large village-project level sample, we report results with and without sub-district fixed effects. And we discuss the effect on all reported later results of adding sub-district fixed effects. The problem especially in smaller samples of villages is that individual aid agencies tend to cluster their operations spatially to reduce costs of operation and some of that clustering spreads to the implementer type at the sub-district level. In smaller samples of villages, in the few cases where adding sub-district fixed effects actually makes a difference, we will explain specifically when we think the effects are spurious due to lack of variation within sub-districts of implementer types for those cases.

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[11] For the 8 with poor government data on post-tsunami population and household counts, including those has a strong effect on the coefficient on post tsunami household, which becomes much smaller presumably because of measurement error, although still positive and significant. But aid results are not affected.

IV.2 Project-level analysis: Subjective quality ratings by village heads

IV.2.1 Basic results

We start with the subjective quality ratings as reported by village heads for the four implementer types. Table 7 looks at subjective quality ratings by the village head of each project on a scale of 1, 1.5, 2, 2.5 or 3, with 3 being highest as noted for Figure 1. The first four columns all have base village characteristics with column 1 including only village covariates and district fixed effects. The fifth column redoes column 4 (our main result), adding two village head characteristic variables, and the sixth column replaces district with sub-district fixed effects. The last column redoes column 4 dropping all covariates and fixed effects. The table reveals that estimated implementer effects are little affected by all combinations of village controls, including sub-district fixed effects.

For implementer-type effects, in column 2 we control for the provider for each specific project, regardless of order as in equation (7). Donor-implementers and international implementers bring similar positive effects, compared to domestic ones or BRR. In column 3 which represents equation (8), the base case is 1st level BRR projects, with effects for 2nd and 3rd level projects for that implementer type. We then distinguish the 3 other implementer types by project level. We note that sample sizes at 3rd level projects are tiny, with each cell containing 2.1-4.8 % of all village projects. Thus in the end we focus on column 4 where we constrain all 2nd and 3rd level project pairs to have the same coefficient.[12]

The pattern we see in columns 3 and 4 is that, relative to the base case of 1st level projects of BRR, 1st level donor-implementer projects offer higher subjective quality projects by 0.44 on the scale to 3. International implementers offer higher subjective quality projects by about 0.33, regardless of project level. That is a basic result. If the implementer in the village is an international agency (donor-implementer or international implementer) they offer higher quality housing, through better monitoring and insistence on quality of construction. For other implementer types, BRR offers the same quality at its 2nd and 3rd level as its 1st level and quality for domestic implementers does not differ from BRR.

However, there is a twist for donor-implementers. The gain in quality for donor-implementer 1st level projects evaporates at the 2nd and 3rd level. This could suggest that donor-implementers act strategically to put less effort in quality as their prominence in a village fades. That is a relationship we

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[12] We thought of similarities to the child quality-quantity trade-off literature (in particular Black, Devereux, and Salvanes, 2005), where parents make decisions about children's education and numbers of children and birth order matter. If villages were really in control of this, absent aid agency choices and strategic interaction with agencies, we would model quality as a function of whether a project was in a 1, 2 or 3 project village and whether "birth order" mattered, or whether this was the 1st, 2nd, or 3rd level project in the village. In this case, we are ordering projects by size, and while our information on order is limited, it appears that in general the largest project in a village was the first one. In such a formulation coefficients on number of projects and project order are usually insignificant; and once we control for implementer types all traces of order and number of project effects go away.

explore in the next table. For international implementers there is no quality decline as they lose dominance; they seem to offer a generic good construction quality house.

The discussion presumes we are talking about causal effects, in the sense that conditional on type, agency housing quality is not influenced by any village characteristics matched to agency type. Aid quality is largely determined by aid agency policy applied uniformly across villages. Variation in agency outcomes across villages is based on difficulties with specific contractors, construction crews, or materials the agency happens to assign to any particular village and village heads' perceptions of quality. In Table 2 we argued that evidence of matching, so that villages with more devastation or higher pre-tsunami measures of social capital get better agencies, is limited. Here we argue that even if there is matching, there is no further consistent influence of village characteristics on quality of aid delivered. In column 1 without implementer types, no village covariates are correlated with quality. In column 5, additionally controlling for whether the original village head survived the tsunami and is still in office and the education level of the village head in 2007, when housing construction was at its peak, has no predictive power on quality and does not change coefficient estimates of the other variables. In column 6, relative to 4, adding a fine control for culture and informal institutions in the form of 31 sub-district fixed effects has little impact on implementer-type point estimates. Finally in column 7, removing all village covariates and all fixed effects also has little impact on implementer-type effects. While we can't prove there are no unobservables that matter, the absence of any relevance to observables in affecting quality is a strong argument. We considered IV work focusing on the main housing provider in a village. Instruments include the weak matching covariates. Second, as noted earlier, individual NGOs tend to cluster in sub-districts. So using RAN, we constructed measures of the extent of clustering by agency type (outside the own village) in a sub-district. These as well as the matching variables are too weak instruments to use in IV estimation.[13]

Before proceeding, we note a number of projects have what we call "guarantees": they test for quality of cement used in construction and they may offer a six month to one year guarantee to repair defects. There is an association between the offering of guarantees and quality as reported in Appendix 4, but we can't argue the relationship is causal. We don't have evidence that failing a cement test or failing to honor a repair "guarantee" brings any penalty. For some agencies, guarantees are not correlated with better quality. While offering guarantees could mean some agencies may then build better houses, it could also mean that, in the presence of within agency heterogeneity across villages in quality, agencies only offer guarantees for the better houses they provide.

IV.2.2 The donor-implementer twist

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[13] Part of the weakness occurs because actual clustering is at the individual agency level, not at the type level.

An intriguing aspect of Table 7 is that donor-implementers shade quality once they lose dominance. We now explore this finding in detail. We start with a general version, where to isolate effects we alter the structure in column 3 of Table 7 by removing the constant term and having dummy variables for each project level by type of implementer. Then for all 1st level projects by implementer type, we add that variable interacted with the fraction provided by other projects in the village. While fractions are endogenous, we note in the model that quality is only affected by the unobserved γ through its effect on fractions provided. That is, in optimizing in equation (4), γ does not directly affect the choice of e_2. The only fraction variable across all implementer types that is significant is the one for donor-implementer.[14] Accordingly, we use a restricted, "preferred" specification in column 1 of Table 8, based on column 4 of Table 7 to illustrate that results are consistent with earlier discussion.

In column 1 of Table 8, as the fraction of housing provided by other projects rises from 0, donor-implementers reduce quality of their first level projects. By the time that fraction of others hits 40% (generally about the maximum of others relative to a 1st level project), the advantage of quality for a donor-implementer on a 1st level project is reduced from 0.60 to 0.21. This suggests donor-implementers are sensitive to their degree of control in paying for better quality construction and monitoring.

Do these effects in fact reflect agency policies per se? They might arise if there are differences in the composition of specific donor-implementers at different project levels and differential overall policies of those NGOs. In particular, British and Canadian Red Cross's never have 2nd or 3rd level projects and almost always totally dominant housing provision in their villages. Maybe the results arise because they have better quality housing than all other donor-implementers. We reran the base specification in column 1 of Table 8 for two sub-samples. First in column 2, we drop the British and Canadian Red Cross villages from the sample, getting almost the same results as in column 1. Then as an extreme, we drop all villages except those where the 6 largest donor-implementers (UN, WVI, CRS, German Red Cross, Australian Red Cross, Turkish Relief) who routinely operated at different levels in different villages appeared. The results in column 3 are not highly significant given the small sample but the coefficient patterns are consistent with columns 1 and 2. Composition does not seem to be driving the results.[15] Finally, we note that replacing district by sub-district fixed effects in Table 8 has no significant effect on outcomes.[16]

IV.3 Individual level analysis: Quality ratings by fishermen

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[14] The estimates of the coefficient [standard error] of the fraction variables are as follows: donor-implementers -0.98 [0.33], international implementers -0.23[0.74], domestic implementers -0.23[0.68], and BRR -0.43[0.59].

[15] More generally, we also worked to find heterogeneity of donor-implementer effects by specific grouping such as all the Red Cross's or all Christian based NGOs, but found no consistent evidence of differential effects.

[16] Column 1 and 2 results are not affected. In column 3 the coefficient on ratio of others is weakened (changed to -.425) but the sample is tiny and spatially clustered.

We now turn to a sample of several hundred fishing families who received a house on aid, name an agency we can identify and categorize, and have corresponding information on different house quality dimensions. The fisherman data have much more detail about individual house quality, but fishermen reside in only 90 of our villages in 2009. We note before starting that the basic results in column 4 of Table 7 are maintained in the sample of 90 villages. As reported for relevant variables in Appendix 4, column 3, the only noticeable change for this sample of 157 projects is that the coefficient on first level projects for domestic implementers (relative to BRR) becomes strongly negative and significant. We note our fishermen sample is representative of the types of agencies operating in the 90 villages. [17].

Fishing families are asked about four specific faults: do they have a leaky roof, cracked walls, a poor foundation, or faulty plumbing. We look at these as a count of total faults, as well as individually. The question is whether the findings from the village level data are confirmed by individual micro data, for the sub-sample of villages where we survey fishermen. By design, fishing families consist primarily of traditional fishing boat owners and captains (rather than crew, where the typical boat (*thep-thep*) has a captain and 2-3 crew often family members). We have results on two samples. First are 529 families, where we type housing agencies according to the agency named by the household head. Second is a smaller sample of 371, where we require an agency named by a household head to match one named by his village head so as to reduce noise in household head knowledge of implementer identity. Household heads know names of domestic implementers (with *Bahasa* Indonesian names) and BRR and the village head-household head matching has a high rate of success for these. For international NGOs matching was less successful. Village heads negotiate and sign contracts with agencies, so they have a good sense of specific names of foreign NGOs and who really were the agencies responsible for housing. Given the myriad of agencies operating in villages, villagers are sometimes confused about exact foreign names and what actual agency supervised the contractor who built their house. [18] We match just over half the sample on name alone and add another 20% by matching by implementer type.[19] The matched sample of 371 has only 29 international implementer projects, which makes inferences for this type more tenuous.

In examining the quality of housing received by fishermen, as before, we keep BRR as the base. For fishing families, in Table 9 we examine overall fault counts and then probits for each individual fault. In each column in the table except one, we have the basic village controls from before including district

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[17] We compare the actual and expected (if randomly assigned within the village) counts of houses received by our fishermen by agency types for the larger sample of fishermen. The actual counts and expected counts for donor implementer are [174, 178], international-implementer [60, 46], domestic implementer [207, 189] and BRR [118, 146]. The fishermen data seem to represent fairly well the counts reported by the village heads.

[18] Also a village head may name one agency (say, a donor) and the villager another (say, the implementer) when both are involved, although we worked hard to overcome this problem (a specific donor typically hires just one or from a small set of implementers).

[19] When the level 1 type is the same as the level 2 or 3 type we assign it as the level 1 type. There are 34 instances of these and we also try dropping such cases but the results are similar.

fixed effects, the type of implementer providing housing to the family, and basic family controls of size and age and education of the household head. None of these family and village controls are significant and we don't report their coefficients in this table. For the moment we focus on the total fault results. Estimation in column 1 is a Poisson count model with robust and village clustered standard errors. We note that households don't routinely report faults in all categories: in the larger sample 52% report none, 18% one fault, 17% two, 8.6% three, and 6.7% four.

For total faults in columns (1a) and (1b) we report for the larger and then the better matched samples, with district fixed effects. Then as in Table 7 we report a column (1c) with no village or family controls and no fixed effects. In columns 1a-1c, consistent with village head results, donor-implementers offer lower counts of faults than BRR—a 40% reduction for the larger sample and a 60% reduction for the better matched sample in columns (1b) and (1c). International-implementers also have lower counts, although in the large sample in column (1a) the estimate is small (which could reflect measurement error). In columns (1b) and (1c), reductions are 81% and 91% respectively, but both are imprecisely estimated. Domestic implementers have similar counts to BRR. To column 1a, if we add sub-district fixed effects, results are unaffected. In column 1b with its smaller sample, the only effect is to strengthen (and make significant) the reduction in faults for international implementers. However, that strengthening is based on 29 international implementer observations, 13 of which are in one sub-district with no donor-implementers and only 2 BRR projects.

We also looked at these effects on total faults according to whether the household got the implementer-type house from a 1st, 2nd, or 3rd level project, as well as the extent to which a 1st level project dominated aid in the village. For that, we must use the better matched sample which distinguishes the levels of the agency reported by the fishermen. The results reported in Appendix 4 column 4 are consistent with the column 4 results of Table 7 for village head ratings. The noticeable difference is that, for donor-implementers, now 2nd or 3rd level projects, as well as 1st bring significant reductions in counts of faults, but cell counts are small.

In Table 9, columns 2-5 report probits on whether the house has a leaky roof, cracked walls, poor foundation, or faulty plumbing. We report just on the smaller better matched sample which has stronger results for donor-implementers and international implementers, consistent with less measurement error for those two variables. In the probits, donor-implementers are significantly less likely to have 2 of the 4 faults at the 5% level, one significantly less at the 10% and one just missing the 10% mark. However for international implementers, only one fault is significantly less at the 5% level and one at the 10% level. Domestic implementers show no differences relative to BRR.

The individual fishermen results reinforce those for village heads. Donor-implementers offered high quality aid and so did international implementers but effects for the latter are not precisely estimated. Domestic implementers and BRR offer houses that were more poorly constructed.

IV.3.1 Other dimensions of quality

In Table 10 in columns 1 and 2, we look at two other "quality" related items. One is the fraction of houses in a village provided with a piped water connection. Since these are village level data, we ask whether the dominant house provider in a village affects the fraction of houses served. Not surprisingly in column 1, the donor-implementer houses are more likely to be connected; effects for international implementers relative to BRR are positive but not significant.

The other dimension of quality is house size. We asked for total number of bedrooms (ranging from 0-6, heavily centered on 2) and about additional special rooms, namely kitchen and bathroom, sometimes left for the family to build onto the house. We get a count of total additional rooms (additional to a one room box) by adding one if there is a kitchen and one if there is a bathroom to the count of bedrooms. We estimate whether the count of additional rooms relative to a one room box is influenced by the implementer type. Here we report on the whole set of control covariates in columns 3 of Table 10 for the larger fishermen sample, with results being the same for the better matched. None are significant at the 5% level. In particular, a larger family size does not mean a larger house, indicating how little village and family conditions affect outcomes. Relative to BRR, the count of additional rooms is the same across agencies except for domestic implementers. They provide on average 9% fewer rooms. Overall, domestic implementers offer lower quality and smaller houses than donor-implementers. As in Tables 7 and 8, results are not significantly affected by replacing district with sub-district fixed effects.[20]

IV.4 Quantity of aid

In the last 2 columns of Table 10, for completeness, we look at the reduced form determinants of the number of houses provided on aid in each village. Column 3 shows the number is related to basics: increasing in houses destroyed (aid claim) and numbers of surviving households (need). In column 3 the only other significant determinant is the village population survival rate, where aid is decreasing in survival rate, conditional on houses destroyed and surviving numbers of households. It may be that there was more sympathy in giving to villages with the lowest population survival rates. Distance from Banda Aceh and social capital measures have no significant effect on total house aid.

In the theory section, we showed that if all villages have the same tastes for excess housing and heterogeneity is in implementer tastes for, say, domination or quality, villages will still opt for the same amount of housing regardless of the tastes of their main implementer. Does having more agencies and less

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[20] In column 1, the key donor-implementer effect is unaltered. The value of the other two implementer-type coefficients are reduced. Column 2 results are unaffected.

domination in the village affect overall quantity provided or does the type of main provider matter? To answer these questions, in column 4 we add in controls for having two or more housing providers and for the main implementer type. None of these variables are significant at the 5% level, although having a second provider is significant at the 10% level. This latter weak effect is consistent with the model. In the model there is a margin where having multiple providers affects quantity, which may explain the weak positive correlation between total aid and numbers of providers. If villages are heterogeneous in their unobserved tastes for extra houses; and, as noted in the theory section, we are at the margin of a corner solution where the main provider strategically dominates (as opposed to shares provision), then an increase in village unobserved taste for extra houses will induce a solution with an extra provider and more houses. However in cases where provision is already shared, an increase in village tastes for extra houses creates no association between more houses and having a second agency.

Adding sub-district fixed effects has no impact on implementer-type coefficients. If we add agency fixed effects as a more general control on agency tastes for housing provision, the multiple provider coefficient is reduced (coefficient (s.e.) of .060 (.084)). The results are supportive of the model overall. There is also no suggestion of a "quantity-quality trade-off." [21]

V. Social agendas: Why domestic implementers might be chosen for aid delivery.

In this section we look at two issues. First, is there evidence donor-implementers value social agendas more than, say, international implementers? Second, given domestic implementers deliver low quality housing, is there any evidence that they "work better with the community" in the pursuit of village social goals, which might explain why some donors choose domestic implementers? Our evidence meets no reasonable standard of causality on either issue. Matching is now an explicit problem where village measured covariates influence social outcomes; and we are not looking at specific agency actions, only associations with their presence. Still the patterns of association are so pointed that we report them.

We look specifically at two types of village social outcomes: (i) public goods in the form of public buildings and infrastructure (specifically paved roads and environmental protection of the coast) and (2) preservation of local traditions specifically mosque attendance post-aid in 2009 and choice of traditional occupation, fishing. For domestic implementers for public goods, the idea is that they are more knowledgeable about the local scene (speak the language and know the culture) and may be better connected personally with BRR officials who are the key providers of many public goods. Thus domestic implementers may be more willing and able to help villages get more public goods. Since generally house

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[21] We also considered the issue of "quantity-quality trade-off." This is not the micro trade-off analyzed in the human capital literature on children, just correlations in the data. We computed residuals for excess housing from column 3 of Table 10 and added them to a column 1 Table 7 quality specification (with the full or reduced set of village covariates, but no implementer types). Adding that measure of excess housing and that measure interacted with whether a village has two or more providers produces zero coefficients on the excess housing variable and any interaction with multiple providers. It seems excess housing per se is not associated with lower quality.

NGOs don't provide these facilities, it means that the main house provider must work with other implementers to help a village get particular public buildings or infrastructure. For social agendas involving local traditions, Aceh is a conservative Islamic area of Indonesia. Foreign NGOs in villages bring exposure to new ideas and social influences—an issue of foreign "spiritual pollution". Domestic implementers may associate more with village traditions and they have the same religion as villagers.

For donor-implementers, they may have detailed and specific social agendas about which we have no information. All we ask here is whether, compared to BRR or international implementers, it seems their objective functions weigh more heavily villages getting public goods and whether they may be more sensitive to village traditions (as donors willing to be on-the-ground in the village).

Results are summarized in Table 11. The first four columns look at village level outcomes, where we see if the main house implementer type [22] is correlated with the count of public buildings, the count of cooperatives and village enterprises, the fraction of roads paved, and whether coastal protection initiatives were undertaken for the sub-sample of coastal villages through planting of mangroves, pines and grasses.[23] Public buildings include mosques, village halls, fishermen halls, Islamic and state schools and health facilities. On the role of domestic implementers, they shine, being associated with consistently better outcomes than BRR and relatively better outcomes than at least international implementers. For donor-implementers, they do a better job than international implementers, as presumed in the modeling section. Note that all NGO types dominate BRR; none are worse than BRR for any item in the first 4 columns.

In columns 5 and 6 of Table 11, we look at social outcomes as a function of the type of major housing provider. In column 5, we have mosque attendance in 2009 after aid delivery is complete.[24] The village tradition is that the household head answers the call to mosque at least once a day and we examine weekly attendance with counts for household heads ranging from 0-7 days. Column 6 concerns the issue of whether NGOs influence occupational choice. Does the choice to remain fishing in 2009 for a sample of pre-tsunami fishermen relate to the type of main house implementer? Both columns have a full set of relevant controls with complete results presented in Appendix 5. In columns 5 and 6, compared to either BRR or international implementers, domestic implementers are associated with higher mosque attendance of adult males and higher probabilities of fishermen remaining in fishing (the difference between domestic implementers and international implementers in column 6 is significant). Although donor-implementers have higher point estimates than international implementers, their coefficients in columns 5 and 6 are not significantly different. In Appendix 5, we also take a different perspective and look

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[22] We also experimented with a formulation where covariates are the fraction of houses in a village provided by each type of agency. The sign and significance patterns are the same as for the dummy variables for dominant providers.
[23] About 45% of coastal villages plant mangroves, pines and grasses.
[24] For mosque attendance in 2007, with NGOs still directly present in villages, we find no agency effects.

explicitly at whether the fraction of houses provided by Christian based NGOs had differential effects. [25] The negative effect for evening prayer is quite large, though statistically not significant. The effect on reduced fishing probabilities is large and significant.

Table 11 associations are consistent with the ideas that (1) some donors hire domestic implementers compared to international ones to help preserve local traditions and work more towards improving village quality of life and (2) donor-implementers work better with villages than international implementers at least in securing village public goods. Adding sub-district fixed effects does not alter the general results in columns 1-4. [26] Columns 5 and 6 with their focus on social outcomes are the one place in the paper where a tight control on culture and informal institutions could be very important. The overall pattern of results is similar, with domestic-implementer effects being modestly strengthened. [27]

While we have these associations, they may not be causal. For example unobserved devoutness in a village may have induced matching with domestic implementers of the same religion. We now turn to an explicit social agenda where we can draw strong inferences.

VI. Imposition of social agendas: boat aid

For boats, social agendas of certain aid agencies imposed shared ownership on a substantial fraction of aid boats, to try to force a move away from the traditional captain-owner-crew social and economic structure. In Figure 2, we saw that sharing did not survive well with time, but the examination is complicated because boat failure is associated with sharing. It could be that the agencies where sharing was a strong social agenda happened to also give poor quality boats. However, there is heterogeneity of boat quality within agencies and aid boats were distributed by village fishing leaders. The question we explore here is whether the fishing leaders who allocated boats further thwarted the unpopular sharing agenda by assigning poor quality boats to shared ownership. That is, for boats from the same agency, better quality ones were not shared, while worse ones were. Further, sharing is not random across fishermen; it was disproportionately imposed on lower status fishermen. We assume (1) that leaders knew which boats would fail, which is plausible since construction materials and ex post quality as well as design are all observable to these experienced fishing leaders and (2) sharing per se did not induce failure, a possibility we directly address.

We use individual fishermen data, which cover 88 villages in the estimating sample. These data allow us to tease out the sharing-failure association in detail, which we can't do with the village level

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[25] We also tried controlling for the type of provider of the individual fisherman's house, in addition to the village level controls. Those variables had no independent effect and left other results intact, so we don't report them.

[26] Column 1 results show little change in coefficients. In column 2 the domestic implementer coefficient is halved.. Column 3 coefficients are reduced by 25-50%. Column 4 coefficients rise by about 15%.

[27] In column 5 the domestic implementer coefficient is a little higher and still significant at the 5% level; and in column (6) the domestic implementer effect is strengthened rising to 0.14, significant at the 10% level.

data. For these 88 villages, two international agencies, Triangle Generation Humanitaire (TGH) and International Medical Corps (IMC), dominate boat aid, providing over 45% of boats to the fishermen we sample, with no other individual agency providing more than 5.5%. Donor-implementers as identified in RAN for boats are a small group. Despite the limitation on villages covered, we have strong findings.

VI.1 Was sharing targeted?

In Table 12 columns 1 and 2, we look at the correlates of sharing as reported in 2007 by fishermen. Family or fishermen characteristics are related to sharing— previous ownership and higher education lower the likelihood of shared ownership. So sharing to some extent seems to have been imposed on lower status fishermen, who had poorer claims to ownership. Across villages, keeping in mind that we cover a limited sample of villages, sharing increases in villages with higher initial social capital (*arisan* group), which have been more willing to better accept the equality agenda underlying shared ownership. Sharing declines as boat aid rises in a village, suggesting not surprisingly that, in villages with fewer aid boats relative to need, sharing was more likely to occur.

In terms of aid agencies which favored sharing, in the small sample of villages, it is difficult to separate NGO effects from the 3 district fixed effects let alone 31sub-district fixed effects; and we include no fixed effects. IMC which gave 16% of boats in the estimating sample with an 87% share rate are all in one district. TGH which gave 29% of boats with only a 36% share rate is entirely in another district. As Table 12 shows, IMC has significantly more and TGH significantly less than typical sharing (compared to the base of small, ungrouped boat NGOs). British Red Cross (BRC) which favored imposed shared ownership appears only appears only 3 times in the sample. Given all agencies besides IMC and TGH appear infrequently, we tried other groupings. Getting a boat from a boat donor-implementer identified in RAN (3.6% of boats), or from BRR (8.8% of boats) are unrelated to sharing. Regardless, what drove differences in sharing is not critical to the basic results in columns 3 and 4.

VI.2 Assigning sharing to failure

In columns 3 and 4 of Table 12, we turn to failure of aid boats, as recorded after aid was done in 2009. Failure is not related to household or village observables. However, sharing an aid boat significantly increases the likelihood of boat failure, 30% more in column 3.

Column 4 shows specifically that failure is associated with being assigned a shared boat, not with an implementer type per se. In column 4, we examine how sharing versus non-sharing, in association with the NGO group classification in column 2, affects failure. The base case is non-shared boats given by "all other" agencies; there are no BRR boats left in the sample. No non-shared IMC boats fail so there is no estimated coefficient. TGH and IMC shared boats fail at significantly higher rates, by about 40%, compared to the base and even more compared to TGH non-shared boats. Non-shared boats by donor-

implementers fail less than other non-shared boats, consistent with the house results, again the idea of better resolved moral hazard problems.

Overall the results suggest that fishing leaders in allocating boats in villages knew which were good and bad boats at the point of assignment. They then assigned the low quality boats to be shared, to satisfy the shared ownership objectives of NGOs. Such sharing was assigned to villagers lower in the social hierarchy (lower education, not pre-tsunami owners).[28]

A concern is that people did not like sharing and so they could have used the boats very hard to raise money to buy out partners. Could they have used them so hard that rather than starting to fail after 5 years they failed within 1-2 years or less? This appears not to be the case. In a smaller matched sample of 2007 and 2009 fishermen, we control for intensity of use in 2007 in terms of length and numbers of trips per week to make sure that higher usage of shared boats is not driving later failure rates. As reported in columns 5 and 6 of Table 12, the two usage variables have tiny coefficients and are completely insignificant; other results are the same as in columns 3 and 4. Failed boats were just badly built.

VII. Conclusion

In recent years, many countries have experienced major natural disasters and the massive accompanying humanitarian aid efforts have not been well scrutinized at a micro level. Understanding and analyzing the organization of aid delivery is essential to evaluating aid efficacy and how donor monies are spent.

We find that donor-implementers offer the highest quality housing as rated by village heads and have fewer counts of faults as reported by fishermen, reflecting their greater ability to deal with moral hazard issues. However, evidence suggests they shade in quality as they lose dominance as the leading aid agency in a village. International implementers fare relatively well in providing housing quality, regardless of degree of dominance. In contrast, domestic implementers provide lower quality housing, but are associated with more construction of public buildings and seashore conservation. They also are associated with better maintenance of village religious and occupational traditions.

We investigate the interaction of aid quality and social agendas by examining boat aid. Shared ownership was the primary social agenda pursued by many agencies delivering boat aid, perhaps in the hopes of reducing within village inequality and improving contractual practices. However, boat aid was extremely heterogeneous with many boats literally failing. We find that village leaders steered poor quality boats towards those upon whom shared ownership was imposed, often lower status fishermen. In other words, under heterogeneity of boat quality, shared ownership which was imposed as a means to decrease inequality resulted in the contrary, where higher status fishermen receive better boats and the lower status poorer quality boats.

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[28] A "reduced" form for failure (remove sharing variables in columns 3 and 4) gives anticipated effects by status but they are not statistically significant.

What are the policy implications? The behavior of an aid agency that operates on the ground is a composite outcome of the organizational structure of the donating and implementing arms. Depending on that organization, the quality of hard aid and the delivery of social agendas may vary considerably within the same disaster area. Monies from international governments and multi-lateral funds funneled through the receiving country's national government may be poorly spent. Better dissemination of the links between form of delivery and aid outcomes may help private citizens and organizations who donate to NGOs make more informed choices.

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Figure 1. Housing Aid: Quality by types of aid agencies, village head and fishermen 2009
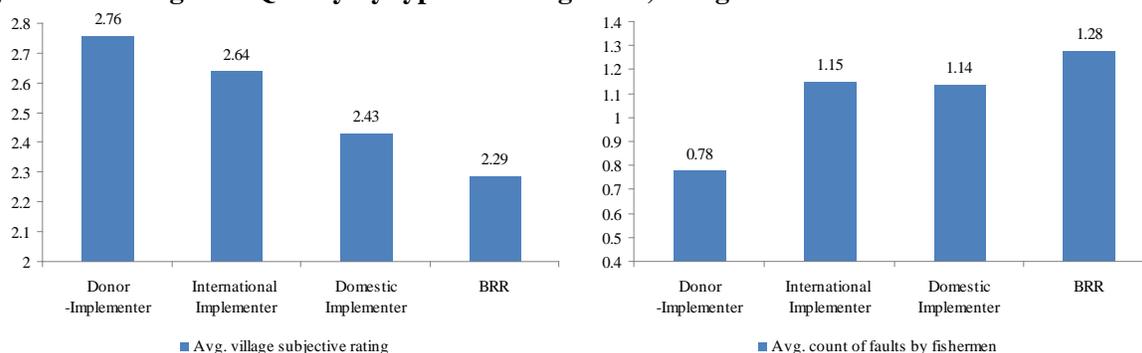
Figure 2. Boat aid: Shared ownership and boat failure, fishermen 2009

Legend:
- ■ % abandoned because of poor quality
- ■ Still sharing in 2009

Bar values:
- Total boat aid (324): 32.4%, 8.6%
- Shared ownership (141): 53.2%, 19.9%
- Sole ownership (183): 16.4%, 0.0%
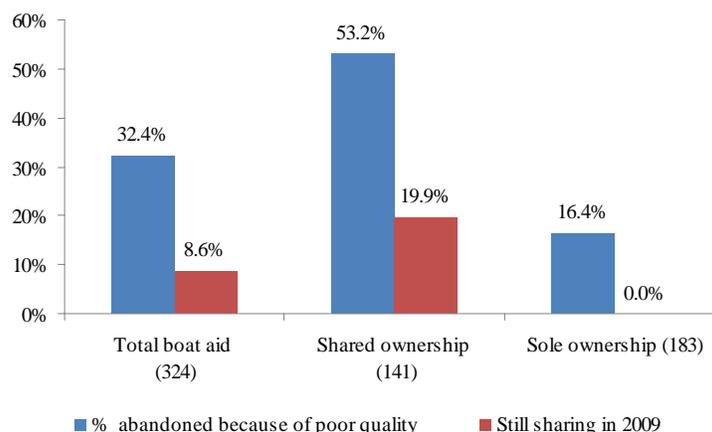
Table 1. Destruction of population and housing

Survival	
Pre-tsunami population [a]	171783 (official)
Survival rate of population [b] [original 05 villages, 104 covered]	**65%** [49%]
Post-tsunami households, official	32876
House aid	
Number of houses survive tsunami, survey	5399
Survival rate houses	**9%**
Number of temporary aid houses built ('07 survey)	6529
Number of permanent aid houses built ('07 survey)	32277
Replacement rate by late 2007 [c]	**117%**
Number of permanent aid houses built by late 2009	39899
Other aid	
Survival rate public buildings	**6%**
Replacement rate, public buildings by late 2007	**80%**
Replacement rate, public buildings by late 2009	96%
Survival rate of boats ['05 sample of villages]	**[6%]**
Replacement rate, boats [2007 survey for 96 villages surveyed in '05] [d]	**[105%]**

Note: Based on 190 villages where there is both 2007 and 2009 information

a. Official population counts pre-tsunami are from the P4B, a 2004 government pre-election census.
b. The official survival rate is the 2006 PODES count divided by the count in P4B. The PODES is a tri-annual government inventory of village populations and facilities. The 2006 PODES in Aceh was conducted in the Spring 2005. It has lower counts of population and households compared to our 2005 survey (Summer and Fall, 2005). This may be partly a "9/11 phenomenon"; as time goes on more missing families are discovered.
c. The replacement rate is the number of houses given in aid divided by the number of surviving households less the number of surviving houses. Includes mosques, village halls, fishermen halls, public and Islamic elementary schools, health facilities.
d. Defined as boats on water by late 2007/surviving captains 2005.

Table 2. Matching villages to types of agencies : Multinomial Logit

	(1) Donor-Imp.	(2) Int'l Imp.	(3) Domestic Imp.	(4) BRR
Ln (no. households post-tsunami)	0.0232	-0.00642	0.0157	-0.0325
	(0.0443)	(0.0298)	(0.0359)	(0.0434)
Survival rate population	-0.00519	0.0148	0.00736	-0.0170
	(0.0658)	(0.0435)	(0.0660)	(0.0766)
Mullah survive	0.00521	4.69e-05	-0.0510	0.0457
	(0.0570)	(0.0478)	(0.0522)	(0.0552)
Pre-tsunami *arisan* group	0.192***	-0.111**	-0.101*	0.0200
	(0.0543)	(0.0555)	(0.0587)	(0.0582)
Ln (distance to Banda Aceh)	0.0530**	0.0393**	-0.0450**	-0.0472*
	(0.0239)	(0.0188)	(0.0220)	(0.0256)
Ln (no. houses destroyed)	-0.0160	0.0195	0.0303	-0.0337
	(0.0308)	(0.0225)	(0.0270)	(0.0268)
Village head survive	0.0189	-0.0708	-0.0101	0.0621
	(0.0703)	(0.0659)	(0.0669)	(0.0692)
Surviving village head graduated from high school	-0.0650	0.0616	0.0640	-0.0606
	(0.0620)	(0.0575)	(0.0641)	(0.0652)
Observations	349	349	349	349

Notes: Coefficients are marginal probabilities reported from a multinomial logit regression. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Housing aid agencies

Agency	No. of houses given	No. of projects [No. of villages]	Houses per project	Percent villages where present, where dominant provider	Percent villages where present, where almost "sole" provider (> 90%)	Percent projects where minimal provision (< 15%)
BRR	**7541**	**117**	**66**	**34**	**17**	**34**
All Donor-Implementers	**18009**	**115 [107]**	**158**	**80**	**43**	**7**
Canadian Red Cross	2358	11	214	100	91	0
Catholic Relief Service	2282	18	127	83	33	6
United Nations	2087	16	130	75	56	0
World Vision International	1977	12	165	75	42	0
British Red Cross	1247	7	178	100	57	0
All Domestic Implementers	**10772**	**96 [85]**	**112**	**45**	**16**	**17**
Uplink	1390	15	97	73	33	7
All International Implementers	**4517**	**61 [56]**	**74**	**34**	**14**	**23**
Habitat for Humanity (Indonesia)	1392	14	99	50	21	14

Table 4. House implementers

Name of housing agency	Type	No. of village projects	No. of houses	Village Head reports		Fishermen reports	
				Mean quality	Mean quality (weighted)	Mean count of faults	No. of fisher-men
Canadian Red Cross	Donor-Imp.	10	1758	3.00	3.00	0.81	27
German Information Technology Executive Council(GITEC)[1]	Donor-Imp.	4	856	3.00	3.00	0.78	9
World Vision International	Donor-Imp.	11	1977	2.73	2.89	0.67	12
Spanish Red Cross	Donor-Imp.	2	250	2.75	2.84		
UN	Donor-Imp.	14	2087	2.82	2.83	0.50	6
Catholic Relief Service	Donor-Imp.	18	2282	2.89	2.83	0.00	12
British Red Cross	Donor-Imp.	8	1247	2.63	2.82	0.43	7
German Red Cross	Donor-Imp.	4	652	2.75	2.78		
Turkey[2]	Donor-Imp.	8	842	2.50	2.58	0.83	23
Australian Red Cross	Donor-Imp.	6	493	2.58	2.49		
CARE	Donor-Imp.	3	544	2.17	2.40		
Samaritan's Purse	Donor-Imp.	5	1232	2.30	2.05		
Save the Children	Donor-Imp.	2	75	1.50	1.93		
Concern Worldwide	Donor-Imp.	2	9	1.00	1.00		
GenAssist/CRWRC [Tearfund UK, Mennonite Central Committee]	Int'l Imp.	10	398	2.60	2.93	0.33	3
International Organization for Migration [Various Governments]	Int'l Imp.	5	328	2.70	2.93		
CHF International [Direct Relief International, USAID]	Int'l Imp.	7	380	2.86	2.84	0.00	2
Emergency Architects [French Red Cross, French Government]	Int'l Imp.	3	325	2.83	2.69		
Oxfam [UK Disaster Emergency Committee]	Int'l Imp.	9	514	2.67	2.66	0.89	18
Habitat for Humanity Indonesia [Mercy Corps International]	Int'l Imp.	13	1392	2.62	2.57		
Church World Services [ACT Alliance]	Int'l Imp.	2	192	2.00	2.00		
Muslim Aid Indonesia [Oxfam]	Int'l Imp.	6	390	2.33	1.92		
KOMPAK [s]	Domestic Imp.	8	599	2.88	2.92		
Caritas [d]	Domestic Imp.	5	890	2.60	2.90		
Education and Information Center for Child Rights(KKSP) [Terre des Hommes]	Domestic Imp.	3	600	2.67	2.77		
Indonesian Government Agencies [d]	Domestic Imp.	5	842	2.30	2.64		
Diakonie Emergency Aid [Katahati Institute]	Domestic Imp.	3	97	2.67	2.53		
United Methodist Committee on Relief [d]	Domestic Imp.	3	31	2.67	2.52		
Uplink Indonesia [Canadian Government]	Domestic Imp.	8	1390	2.44	2.42	1.23	31
Asian Development Bank [d]	Domestic Imp.	5	388	2.40	2.37	0.40	5
SOS Desa Taruna Indonesia [SOS Kinderdorf International]	Domestic Imp.	3	520	2.33	2.23	1.13	32
Aceh Relief Fund [Compassion International]	Domestic Imp.	4	198	1.38	1.69	3.00	4
Salam Aceh [s]	Domestic Imp.	2	172	1.50	1.68	1.75	8
MAMAMIA [Caritas]	Domestic Imp.	6	1068	1.42	1.33	1.50	16
Serambi Kasih/Serasih Indonesia [s]	Domestic Imp.	2	177	1.50	1.25	1.50	2
Nor Link/North Link [World Relief]	Domestic Imp.	2	66	1.00	1.00	2.36	14
BRR	BRR	112	7241	2.33	2.32	1.45	86

Notes: For international and domestic implementers the main donor agencies are listed in brackets.

d. Agencies named by the village head that are primarily donor agencies. In this case, implementing agencies are domestic implementers unnamed by the village head.

s. Agencies named in the survey by the village head but that does not show up in the RAN database.

1. GITEC includes the German Technical Cooperation (GTZ) and the German Development Bank (KFW)

2. Turkey includes ABS Turkey, the Istanbul International Brotherhood and Solidarity Association (IBS), and the Turkish Red Crescent

Table 5. Boat NGOs

Name of boat agency	No. of village projects	No. of boats provided	Failure rate	Failure rate (weighted)
Mercy Corps (several)	8	177	0	0
Church World Services	5	82	0	0
Samaritan's Purse	3	55	0	0
CARDI/NRC(Norwegian Refugee Council)	5	43	0	0
CHF International	3	32	0	0
Asian Development Bank	9	25	0	0
TRIKONI	2	24	0	0
Yayasan Tanggul Bencana di Indonesia	2	22	0	0
Yayasan Panglima Laot	5	18	0	0
Austin International Rescue Operation	4	15	0	0
Padi Nusatra (California Origin)	2	11	0	0
Oman	3	8	0	0
GenAssist/CRWRC	2	3	0	0
International Red Cross	11	67	0.09	0.01
Triangle Generation Humanitaire	38	502	0.17	0.08
Salam Aceh - Greeting Aceh	10	131	0.12	0.12
Austrian Tourism Export Council	3	52	0.33	0.15
Government[1]	50	326	0.31	0.19
World Vision International	6	31	0.17	0.32
BRR	9	21	0.50	0.38
Rumah Zakat Indonesia	3	7	0.33	0.43
International Medical Corps	15	101	0.50	0.50
Japan International Cooperation Agency	2	9	0.50	0.56
Kuwait	5	42	0.62	0.57
Africa Islamic AL-AMIN	3	19	0.72	0.58
France	2	36	0.50	0.83
Oxfam	6	215	0.42	0.84
Yayasan PUGAR	3	19	0.67	0.95
Serambi Kasih/Serasih Indonesia	2	10	1	1

Notes: 1. Government includes various Indonesian government agencies including the Minsitry of Fishing Affairs.

Table 6. Agency typing in the model and outcomes

	BRR	Donor-implementer	International implementer	Domestic Implementer
	$B=8.94$, $z=1$, $\theta=A=0$	$B=12$, $\theta=.9$	$B=12$, $\theta=.2$	$B=10$, $\theta=.6$
	Low house value, no social agenda	High house value, high social value to dominance	High house value, low social value to dominance	Low house value, medium social value to dominance
House quality $(q = Be_2^\alpha)$	40	66.7	68.2	46.4
Δ(max, or corner at 20)	n.a.	19.5	14.4	19.2
Per house effort (e_2)	20	30.9	32.2	21.5
Total social effort (e_1)	n.a.	58.2	57.4	58.1

Table 7. Quality of housing

Dependent Variable:	Subjective Quality						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(no. households post-tsunami)	0.00822	0.00713	0.00430	0.0140	-0.00185	0.0609	
	(0.0648)	(0.0608)	(0.0582)	(0.0592)	(0.0601)	(0.0852)	
Survival rate population	-0.0790	-0.0913	-0.103	-0.110	-0.0929	-0.0906	
	(0.0933)	(0.0920)	(0.0871)	(0.0875)	(0.0851)	(0.0843)	
Mullah survive	0.117	0.130	0.157	0.154	0.146	0.107	
	(0.0996)	(0.0942)	(0.0962)	(0.0956)	(0.0943)	(0.110)	
Pre-tsunami arisan group	0.124	0.109	0.0928	0.0930	0.0730	0.106	
	(0.107)	(0.101)	(0.0994)	(0.0981)	(0.0953)	(0.0949)	
Ln(distance to Banda Aceh)	0.0983	0.0915	0.0743	0.0783	0.104	0.0711	
	(0.106)	(0.103)	(0.102)	(0.0995)	(0.0983)	(0.260)	
Ln(no. houses destroyed)	-0.0265	-0.0261	-0.0300	-0.0328	-0.0329	-0.0495	
	(0.0381)	(0.0347)	(0.0322)	(0.0327)	(0.0329)	(0.0380)	
Village head survive and in office					-0.0467		
					(0.0816)		
Current village head graduated high school					0.0957		
					(0.0821)		
Provider: Donor-Implementer		0.300***					
		(0.0951)					
x 1st project			0.444***	0.443***	0.461***	0.482***	0.496***
			(0.138)	(0.137)	(0.141)	(0.152)	(0.129)
x 2nd project			-0.0732				
			(0.186)				
x 3rd project			0.295				
			(0.314)				
x 2nd or 3rd project				0.0240	0.0134	0.00445	0.100
				(0.181)	(0.183)	(0.193)	(0.188)
Provider: International Implementer		0.312***					
		(0.101)					
x 1st project			0.330*	0.330*	0.325*	0.412**	0.349**
			(0.182)	(0.180)	(0.182)	(0.204)	(0.176)
x 2nd project			0.364**				
			(0.168)				
x 3rd project			0.335*				
			(0.173)				
x 2nd or 3rd project				0.352**	0.347**	0.313*	0.361**
				(0.147)	(0.150)	(0.162)	(0.142)
Provider: Domestic Implementer		-0.0331					
		(0.120)					
x 1st project			-0.187	-0.188	-0.170	-0.206	-0.199
			(0.188)	(0.186)	(0.185)	(0.186)	(0.186)
x 2nd project			0.102				
			(0.186)				
x 3rd project			0.332*				
			(0.171)				
x 2nd or 3rd project				0.166	0.179	0.135	0.162
				(0.162)	(0.160)	(0.169)	(0.155)
Provider: BRR x 2nd project			0.0819				
			(0.155)				
x 3rd project			-0.0728				
			(0.197)				
x 2nd or 3rd project				0.0433	0.0571	0.105	0.0631
				(0.147)	(0.150)	(0.154)	(0.144)
Kabupaten fixed effects	Yes	Yes	Yes	Yes	Yes		
Kecamaten fixed effects						Yes	
Observations	322	322	322	322	322	322	341
R-squared	0.064	0.116	0.163	0.153	0.159	0.237	0.109

Notes: Robust standard errors clustered at the village level are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 8. Donor-implementer quality shading, robustness to composition of NGOs

Dependent Variable:	Subjective Quality		
	(1)	(2)	(3)
Provider: Donor-Imp. x 1st project	0.601***	0.536***	0.802*
	(0.139)	(0.154)	(0.421)
x ratio of others	-0.972***	-0.740**	-0.801*
	(0.331)	(0.365)	(0.425)
x 2nd or 3rd project	0.0199	0.0181	0.675*
	(0.181)	(0.183)	(0.379)
Provider: Int'l Imp. x 1st project	0.340*	0.341*	0.925**
	(0.181)	(0.182)	(0.426)
x 2nd or 3rd project	0.347**	0.343**	0.684
	(0.148)	(0.150)	(0.458)
Provider: Dom Imp x 1st project	-0.196	-0.199	0.454
	(0.186)	(0.185)	(0.474)
x 2nd or 3rd project	0.148	0.144	0.711*
	(0.162)	(0.162)	(0.405)
Provider: BRR x 2nd or 3rd proj	0.0344	-0.0376	0.272
	(0.147)	(0.149)	(0.473)
Kabupaten fixed effects	Yes	Yes	Yes
Observations	322	299	106
R-squared	0.169	0.165	0.273

Notes: All specifications include village characteristics variables as in Table 7. Robust standard errors clustered at the village level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9. Housing quality from fishermen data

Dependent variable:	Count of faults			Leaky roof	Cracked Walls	Poor foundation	Faulty plumbing
	(1a)	(1b)	(1c)	(2)	(3)	(4)	(5)
Provider: Donor-Implementer	-0.417	-0.596**	-0.673**	-0.192***	-0.168*	-0.111	-0.139**
	(0.257)	(0.271)	(0.276)	(0.0695)	(0.0919)	(0.0681)	(0.0698)
Provider: International Implementer	-0.171	-0.812	-0.908	-0.265***	-0.170	-0.123*	-0.0981
	(0.370)	(0.526)	(0.582)	(0.0346)	(0.133)	(0.0666)	(0.0905)
Provider: Domestic Implementer	0.0606	0.0602	-0.0826	-0.0927	0.0176	0.0623	0.0702
	(0.170)	(0.207)	(0.204)	(0.0690)	(0.0888)	(0.0889)	(0.0878)
Household controls	Yes	Yes		Yes	Yes	Yes	Yes
Village controls	Yes	Yes		Yes	Yes	Yes	Yes
Kabupaten fixed effects	Yes	Yes		Yes	Yes	Yes	Yes
Observations	529	371	371	371	371	371	371

Notes: In addition to the same village level controls in Table 7, household size, age, and household head education level are included. For columns (2)-(5), reported coefficients are marginal probabilities from a probit regression. Robust standard errors clustered at the village level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10. Other elements of quality

Dependent Variable:	Percent piped water	Count of rooms	Ln(Count of houses in aid in 2009)	
	(1)	(2)	(3)	(4)
Family size		0.00402		
		(0.00722)		
Age of household head		-0.000140		
		(0.00158)		
Education of HH head (levels 1-8)		-0.00232		
		(0.0101)		
Ln(no. households post-tsunami)	-5.162	0.0349	0.576***	0.568***
	(5.260)	(0.0223)	(0.0892)	(0.0894)
Survival rate population	-0.896	0.00199	-0.190***	-0.185***
	(9.172)	(0.0425)	(0.0727)	(0.0694)
Mullah survive	11.28	0.0560*	0.00180	0.000658
	(7.233)	(0.0340)	(0.0720)	(0.0697)
Pre-tsunami arisan group	1.393	-0.0153	0.0504	0.0570
	(8.342)	(0.0303)	(0.0676)	(0.0721)
Ln(distance to Banda Aceh)	-15.23*	0.0285	-0.0895	-0.0768
	(8.244)	(0.0239)	(0.0667)	(0.0706)
Ln(no. houses destroyed)	1.065	0.00294	0.239***	0.234***
	(3.087)	(0.00961)	(0.0715)	(0.0708)
Two or more housing provider	-11.90			0.107*
	(7.945)			(0.0646)
Agency type: Donor-Implementer	16.19*	-0.00975		0.0179
	(9.794)	(0.0366)		(0.0924)
Agency type: International Implementer	-5.686	-0.0262		-0.0304
	(12.62)	(0.0476)		(0.112)
Agency type: Domestic Implementer	-9.357	-0.0881**		0.0384
	(10.54)	(0.0376)		(0.105)
Kabupaten fixed effects	Yes	Yes	Yes	Yes
Observations	169	486	179	179

Notes: Implementer types in column (1), (2), and (4) are for the major housing provider in the village. Coefficients are reported from Poisson regression in column (2) and OLS in the others. Robust standard errors clustered at the village level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11. Other physical capital and village traditions

	Count public bldgs	Count co-op bldgs	Percent roads paved	Plant pines or grasses	Evening pray count per week in 09	Occupational choice to stay a fisherman in 09
	(1)	(2)	(3)	(4)	(5)	(6)
Major housing provider: Donor-implementer	0.256**	1.083	16.07**	0.241*	0.0608	-0.0701
	(0.102)	(0.817)	(7.509)	(0.133)	(0.0753)	(0.0750)
Major housing provider: Int'l implementer	0.175	-0.183	22.89**	0.296*	-0.115	-0.169*
	(0.122)	(1.003)	(10.10)	(0.171)	(0.0948)	(0.0990)
Major housing provider: Domestic Implementer	0.198*	1.532*	20.64***	0.351***	0.159**	0.0591
	(0.120)	(0.868)	(7.765)	(0.135)	(0.0744)	(0.0716)
Additional village controls	Public bldgs destroyed	Buildings destroyed	Houses destroyed		No. of mosques & dusans	
Family controls					Yes	Yes
Kabupaten fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	184	184	174	147	586	571

Notes: Columns (1), (2), and (5) are Poisson, Column (3) is OLS, and Columns (4) and (6) are probit regressions. All specifications include the first five village variables in Table 7. Column (4) is based on coastal villages only. Column (6) additionally includes the number of aid boats and fishing family in 07, and whether one was a pre-tsunami boat owner or a succeeding fishing household. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

**Table 12. Sharing and boat failure in fishermen data**

Dependent variable:	Shared boat ownership in 07			Discard boat because of poor quality in 09			
	(1)	(2)		(3)	(4)	(5)	(6)
Family size	-0.0205 (0.0188)	0.000334 (0.0180)		-0.0179 (0.0222)	-0.0362 (0.0273)	-0.0143 (0.0233)	-0.0273 (0.0310)
Age of household head	-0.00111 (0.00244)	-0.00238 (0.00263)		0.00140 (0.00343)	0.00384 (0.00335)	4.86e-05 (0.00379)	0.00382 (0.00392)
Education of HH head (levels 1-8)	-0.0326 (0.0238)	-0.0466* (0.0251)		0.0102 (0.0224)	0.0239 (0.0255)	0.0319 (0.0221)	0.0477* (0.0263)
Pre-tsunami boat owner	-0.0929 (0.0623)	-0.137** (0.0613)		-0.0396 (0.0656)	-0.113 (0.0718)	-0.0216 (0.0745)	-0.0924 (0.0903)
Ln (boat aid 07)	-0.151*** (0.0446)	-0.122*** (0.0419)		-0.0335 (0.0339)	-0.0272 (0.0396)	-0.0264 (0.0420)	-0.0256 (0.0479)
Ln (no. fish families 07)	0.0345 (0.0256)	0.0422 (0.0265)		0.0123 (0.0171)	0.0224 (0.0174)	0.0332 (0.0266)	0.0485* (0.0290)
Ln(no. households post-tsunami)	-0.0607 (0.0743)	-0.188** (0.0762)		0.0379 (0.0564)	0.0494 (0.0625)	-0.0236 (0.0600)	-0.0233 (0.0695)
Survival rate population	-0.139 (0.0967)	-0.0475 (0.115)		-0.430** (0.189)	-0.303* (0.176)	-0.432** (0.202)	-0.222 (0.192)
Mullah survive	0.0520 (0.0921)	0.0513 fishing		0.0511 (0.0929)	0.0581 (0.0958)	0.0821 (0.0987)	0.116 (0.100)
Pre-tsunami arisan group	0.196** (0.0762)	0.166** (0.0727)		-0.0739 (0.0801)	-0.0716 (0.0836)	-0.135 (0.0985)	-0.161 (0.0985)
Ln(distance to Banda Aceh)	0.206*** (0.0647)	0.0811 (0.0773)		0.122** (0.0542)	0.115 (0.0714)	0.163*** (0.0574)	0.133 (0.0876)
			Shared ownership	0.292*** (0.0892)		0.295*** (0.0954)	
Boat NGO : TGH		-0.183** (0.0901)	TGH*Share		0.425*** (0.151)		0.381* (0.212)
Boat NGO : IMC		0.482** (0.193)	IMC*Share		0.370** (0.154)		0.457*** (0.162)
Boat NGO: Boat D-I		0.150 (0.221)	Boat D-I*Share		0.151 (0.233)		0.0971 (0.205)
Boat NGO: BRR		0.0946 (0.137)	Rest*Share		0.107 (0.132)		0.180 (0.166)
			TGH*Not share		-0.137 (0.107)		0.0121 (0.150)
			IMC*Not share		n.a.		n.a.
			Boat D-I*Not share		-0.312*** (0.0629)		-0.298*** (0.0648)
			Hours per fishing trip			0.00724 (0.0150)	-0.00567 (0.0160)
			Number of trips per week			0.0492 (0.0506)	0.0785 (0.0551)
Observations	389	389		281	257	212	192

Notes: Robust standard errors clustered by village are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

ALL APPENDICES ONLY FOR ON-LINE PUBLICATION

Appendix 1. Map and survey area

The figure shows a map of the survey area, with a blow-up (right side in figure) of the Banda Aceh area (upper-left part of coastal area). [1] We cover all villages in three contiguous districts (Banda Aceh, Aceh Jaya, and Aceh Besar) going south and north-east of the capital Banda Aceh. In addition we covered the fishing villages in two other districts, up to a defined geographic limit moving east from Banda Aceh into Pidie (the last sub-district surveyed is Meurah Dua) and moving south into Aceh Barat (the last sub-district surveyed is Meuruebo). These include villages on islands offshore. The map shows household survival rates by village (yellow being the worst). Unfortunately, the map is based on the post-tsunami government rendering of village boundaries which is grossly inaccurate. We took GPS readings of the center (the mosque) of the living area of each village. In only 6% of the cases is the GPS reading within the supposed village boundaries. In 15% of the cases, it is over 10 kilometers away. Coastal villages are drawn as non-coastal and vice-versa which explains why, in parts of the map, a yellow (low survival) village may be shown next to a supposed coastal village which is dark (high survival). Nevertheless the map depicts the general survey area.

Survival Rate and Flood Damage for Aceh in 2004
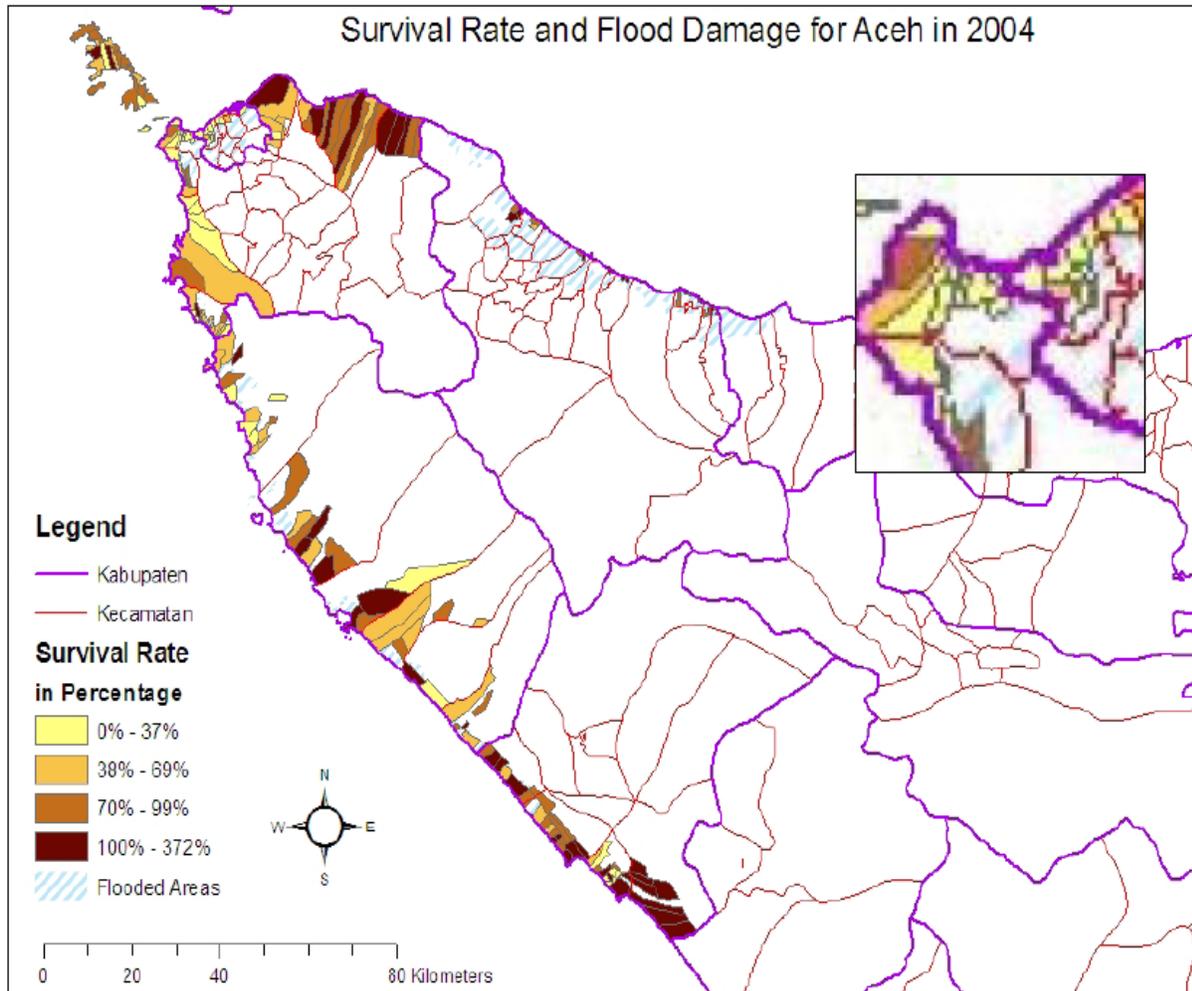
Appendix 2. House and boat NGOs operating in one village

a. House NGOs operating in one village

| Name of housing agency	Type	No. of village projects	No. of houses	Village Head reports		Fishermen reports	
				Mean quality	Mean quality (weighted)	Mean count of faults	No. of fisher-men
Yayasan Budha Tzu Chi	Donor-Imp.	1	850	3.00	3.00	1.33	3
Islamic Relief	Donor-Imp.	1	668	3.00	3.00	0.00	4
Indonesia Red Cross	Donor-Imp.	1	401	3.00	3.00	1.00	2
Yayasan Budha Suci	Donor-Imp.	1	241	3.00	3.00		
The Salvation Army	Donor-Imp.	1	109	3.00	3.00		
Brunei Darussalam	Donor-Imp.	1	70	3.00	3.00		
Terre des Hommes	Donor-Imp.	1	48	3.00	3.00	3.00	5
World Relief	Donor-Imp.	1	42	3.00	3.00	0.00	3
Qatar	Donor-Imp.	1	170	2.50	2.50	2.00	1
Bakrie Group	Donor-Imp.	1	204	2.00	2.00	1.33	3
CARDI/NRC(Norwegian Refugee Council)	Donor-Imp.	1	202	2.00	2.00		
Chamber of Commerce and Industry of Indonesia(KADIN)	Donor-Imp.	1	100	1.00	1.00	0.00	3
Atlas Logistique	Int'l Imp.	1	274	3.00	3.00	0.00	6
Islamic Development Bank	Int'l Imp.	1	167	3.00	3.00		
Jesuit Refugee Services	Int'l Imp.	1	106	3.00	3.00		
Sara Henderson	Int'l Imp.	1	51	2.00	2.00		
Sinohidro China	Domestic Imp.	1	606	3.00	3.00	0.00	2
P2KP (Program Penanggulangan Kemiskinan di Perkotaan)	Domestic Imp.	1	400	3.00	3.00		
Lion's Club	Domestic Imp.	1	250	3.00	3.00		
GAA and Hivos funds	Domestic Imp.	1	184	3.00	3.00		
Welthungerhilfe	Domestic Imp.	1	174	3.00	3.00		
Yayasan Sosial Kreasi	Domestic Imp.	1	118	3.00	3.00		
YAKKUM Emergency Unit	Domestic Imp.	1	118	3.00	3.00		
Plan International	Domestic Imp.	1	96	3.00	3.00		
Yayasan Tanggul Bencana di Indonesia	Domestic Imp.	1	38	3.00	3.00		
Yayasan SHEEP	Domestic Imp.	1	31	3.00	3.00		
World Bank	Domestic Imp.	1	309	2.50	2.50		
Chinese Red Cross	Domestic Imp.	1	300	2.50	2.50	0.00	1
Kuwait	Domestic Imp.	1	2	2.50	2.50		
The Saudi Charity Campaign	Domestic Imp.	1	256	2.00	2.00	0.60	10
Yayasan Berkati Indonesia	Domestic Imp.	1	90	2.00	2.00	2.00	4
CORDIA Medan	Domestic Imp.	1	72	2.00	2.00		
Soroptimist International of Jakarta	Domestic Imp.	1	220	1.00	1.00	1.00	3
Mercy Corps (several)	Domestic Imp.	1	200	1.00	1.00	2.00	1

b. Boat NGOs operating in one village

Name of boat agency	No. of village projects	No. of boats provided	Failure rate	Failure rate (weighted)
German Information Technology Executive Council(GITEC)[1]	1	50	0	0
Catholic Relief Service	1	35	0	0
Saragih (rich person)	1	34	0	0
Tearfund	1	17	0	0
Yayasan Sosial Kreasi	1	10	0	0
CARE	1	8	0	0
Yayasan Berkati Indonesia	1	7	0	0
Aceh Relief Fund	1	6	0	0
AUSTCARE	1	6	0	0
ACTED - Agency for Technical Cooperation	1	5	0	0
YPK	1	5	0	0
Personal Aid	1	3	0	0
Save the Children	1	2	0	0
British Red Cross	1	1	0	0
Obor Berkat Indonesia	1	1	0	0
YJK	1	1	0	0
Diantama (Rich Person)	1	5	0.20	0.20
World Relief	1	25	0.40	0.40
UN	1	50	0.50	0.50
Food and Agricultural Organization	1	9	0.89	0.89

Notes: 1. GITEC includes the German Technical Cooperation (GTZ) and the German Development Bank (KFW)

Appendix 3. Relation between housing quality and excess housing

The top figure illustrates the case where r=0.0002. As the excess housing requested by the village head increases from 20, via reduction in γ, the quality of housing aid declines. However, note that this relationship is positive when excess housing requested is less than 20. This relationship between housing quality and excess housing is sensitive to r as can be seen in the bottom figure. Raising r to 0.00022 makes the relationship monotonic over the whole domain.

Housing aid quality, r=0.0002, θ=0.5, z=0.8

Housing aid quality, r=0.00022, θ=0.5, z=0.8
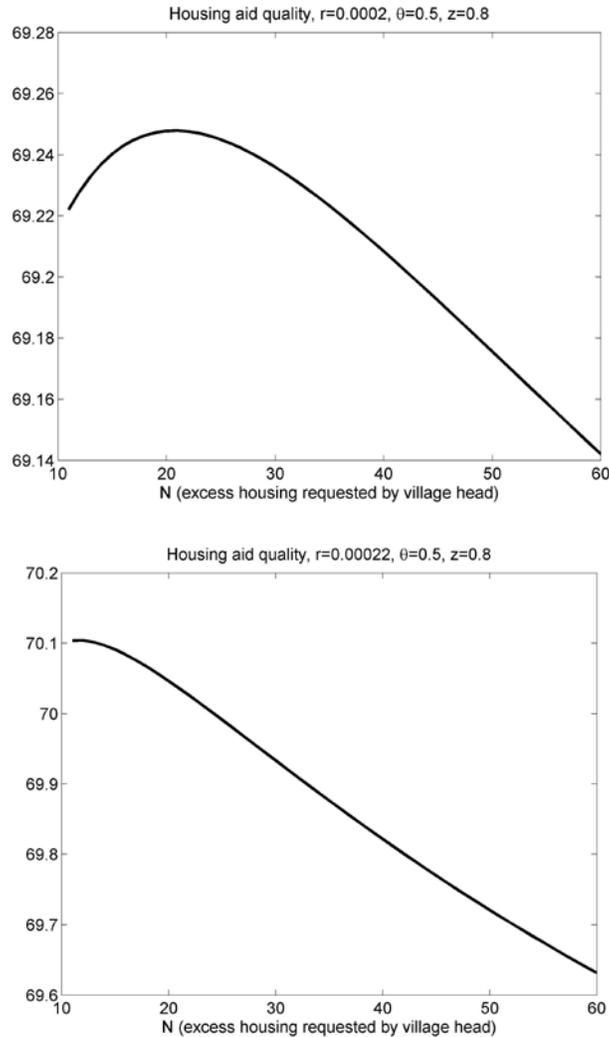
Appendix 4. Guarantees and housing quality reported by village heads and fishermen

In column 1 of the table to this Appendix, the offering of guarantees is only significantly correlated with one village characteristic, whether the mullah survived the tsunami or not. This might suggest that there is some modest room for negotiation about whether guarantees are offered. Donor-implementers are more likely to offer guarantees than other types of agencies, and all types are more likely than BRR. In terms of possible impacts, in column 2, with the exception of BRR, interacting implementer type with the count of guarantees offered (0, 1, 2) suggests overall that the offer of guarantees is correlated with higher house quality. A breakdown (not shown) into each type of guarantee shows both types matter, with the cement composition test being much more widespread and having stronger associations. The fact that guarantees by BRR, a big provider, are not associated with quality improvements suggests the guarantees do not always have real value. Columns 3 and 4 concern other matters discussed in the text.

Appendix 4 table

Dependent Variable:	Guarantees[+]	Subjective quality		Count of faults
	(1)	(2)	(3)	(4)
Ln(no. households post-tsunami)	0.0494	0.00262	0.0486	0.0953
	(0.0777)	(0.0539)	(0.0847)	(0.198)
Survival rate population	0.120	-0.129*	-0.201	0.0370
	(0.0918)	(0.0773)	(0.180)	(0.313)
Mullah survive	0.215**	0.130	0.0633	0.166
	(0.0992)	(0.0922)	(0.113)	(0.228)
Pre-tsunami arisan group	-0.0352	0.0831	0.230*	-0.109
	(0.107)	(0.0974)	(0.123)	(0.170)
Ln(distance to Banda Aceh)	-0.0115	0.0720	0.161	0.119
	(0.0944)	(0.0964)	(0.109)	(0.143)
Ln(no. houses destroyed)	-0.0460	-0.0262	-0.105*	0.0113
	(0.0383)	(0.0307)	(0.0600)	(0.0567)
Provider: Donor-Implementer x 1st project	0.806***	0.303	0.470**	-0.696**
	(0.137)	(0.199)	(0.205)	(0.340)
x 2nd or 3rd project	0.366***	-0.438*	-0.113	-1.192**
	(0.128)	(0.255)	(0.282)	(0.566)
Provider: Int'l Implementer x 1st project	0.246	0.192	0.298	-0.717
	(0.197)	(0.237)	(0.303)	(0.540)
x 2nd or 3rd project	0.367**	0.364**	0.548**	-2.688***
	(0.147)	(0.180)	(0.213)	(0.965)
Provider: Dom. Implementer x 1st project	0.269**	-0.367	-0.619***	-0.148
	(0.134)	(0.241)	(0.232)	(0.292)
x 2nd or 3rd project	0.221*	0.0211	0.111	-0.0827
	(0.114)	(0.210)	(0.262)	(0.361)
Provider: BRR x 2nd or 3rd proj	0.163	0.0228	0.124	-0.369
	(0.117)	(0.176)	(0.212)	(0.383)
Gurantee x Donor-Implementer x 1st project		0.166*		
		(0.0897)		
Gurantee x Donor-Implementer x 2nd or 3rd proj.		0.677***		
		(0.150)		
Gurantee x Int'l Implementer x 1st project		0.295**		
		(0.125)		
Gurantee x Int'l Implementer x 2nd or 3rd proj.		0.0448		
		(0.128)		
Gurantee x Dom. Implementer x 1st project		0.329*		
		(0.169)		
Gurantee x Dom. Implementer x 2nd or 3rd proj.		0.323**		
		(0.131)		
Gurantee x BRR x 1st project		0.0983		
		(0.197)		
Gurantee x BRR x 2nd or 3rd proj.		0.109		
		(0.144)		
Fishermen level covariates				Yes
Kabupaten dummies	Yes	Yes	Yes	Yes
Observations	349	322	157	371

Notes: The sample for Column (3) is village projects where fishermen are interviewed and for column (4) is the fishermen where agency levels are known. Robust standard errors clustered at the village level are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$
[+] Guarantees are whether the NGO offered to test cement quality used in construction or offered a six month to one year guarantee to repair defects. If the project has both types of guarantee a two is assigned, and if the project has only one type of guarantee a one is assigned.

Appendix 5. Religious practices and traditional occupations

Dependent variable:	Poisson: Evening pray count per week, 09		Probit: Occupational choice to stay a fisherman in 09	
	(1)	(2)	(3)	(4)
Family size	0.00612	0.0112	0.0352***	0.0375***
	(0.0140)	(0.0137)	(0.0131)	(0.0132)
Age of household head	0.00626***	0.00577***	-0.0108***	-0.0112***
	(0.00205)	(0.00211)	(0.00242)	(0.00240)
Education of HH head (levels 1-8)	0.0218	0.0160	-0.0995***	-0.102***
	(0.0177)	(0.0180)	(0.0191)	(0.0187)
Ln(distance to Banda Aceh)	-0.0370	-0.0439	-0.205***	-0.181***
	(0.0556)	(0.0571)	(0.0480)	(0.0442)
No. of mosques	0.0659	0.0613		
	(0.0435)	(0.0401)		
No. of dusan (sub-villages)	-0.0187	-0.0341		
	(0.0209)	(0.0224)		
Pre-tsunami boat owner			0.0941**	0.109**
			(0.0457)	(0.0456)
Successor fishing family			0.127*	0.132*
			(0.0669)	(0.0681)
Major housing provider: Donor-implementor	0.0608		-0.0701	
	(0.0753)		(0.0750)	
Major housing provider: Int'l implementor	-0.115		-0.169*	
	(0.0948)		(0.0990)	
Major housing provider: Domestic Implementor	0.159**		0.0591	
	(0.0744)		(0.0716)	
Fraction houses by Christian agency		-0.123		-0.226**
		(0.118)		(0.0937)
Village controls	Yes	Yes	Yes + no. of aid boats and fishing family in 07	
Kabupaten dummies	Yes	Yes	Yes	Yes
Observations	586	586	571	571

Notes: Robust standard errors clustered at the village level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Data Appendix

The village surveys in summer and fall 2005, fall 2007 and fall 2009 ask questions about education, experience, and survival of village and religious leaders; population composition by sex and age both before and after the tsunami; migration; occupational structure; destruction of village lands, seawalls, aquaculture areas, docking areas and mangroves; pre- and post-tsunami data on political, legal, and social institutions; pre and post tsunami information on physical capital (houses, boats, public buildings); detailed information on initial and ongoing operations of NGOs, local governments, and relief agencies providing housing, boats, public buildings and restoration of the coast line; and detailed information on the village fishing industry pre- and post-tsunami, including questions on marketing, fishing fleet composition, catch composition and boat replacement. The 2005 survey of 111 villages focused on benchmarking destruction and village conditions. The 2007 and 2009 surveys of 199 villages (including the original 111) focused on aspects of the aid effort and institutional transformation of villages, such as the democratic evolution and quality of aid as related to different types of aid agencies.

The fishermen surveys ask about family structure, occupations, social status, income and aspect of debt and wealth, housing and boat destruction and aid, fishing productivity, and family participation in village activities. The 2005 survey focused on 475 original boat owners and captains in 77 villages (about 40% of surviving captains and owners in those villages), benchmarking family destruction of people, housing and boats, as well as pre-tsunami productivity. The 2007 and 2009 surveys follow these families, marking their rebuilding of families, new occupational choices, aid received, re-establishment or not of fishing activities, and evolving family participation in village life. In the second wave as followed in the third, besides the original families we extended village coverage and added a module for new boat owners— villagers given an aid boat who had never owned a boat. In the second wave (2007) we have about 700 families in 96 villages and in the third wave (2009) after some sorting and attrition we drop coverage to about 635 fishing families in 90 villages.Here our focus is on the quality of aid received and response to low quality boat aid.

We need to empirically classify the aid agencies in Aceh. The agencies we focus on are those reported by the village head in 2009 as having delivered aid in their villages. We classify each agency that shows up in the survey as whether it is international or local, government or private, and its religious affiliation if it has any. However, we are unable to classify each agency's principal or agent, i.e., donor or implementer status in Aceh simply based on agency names. For this we utilize an additional source of data. The Indonesian government, working with the UN, has also recorded aid delivery aspects in the "RAN" [Recovery Aceh-Nias] database [http://rand.brr.go.id/RAND/reference]. We use the RAN database to classify agency types, particularly whether it was an implementing agency or a funding agency or both in Aceh. In RAN, for each project in a village a first level implementer is named as well as the underlying donors, often many in number. A first level implementer is the leading agency that either directly hires the labor to be used in construction or monitors any sub-contractors.

We classify an agency named by the village head as a donor-implementer if it appears as both a donor and implementer in at least 30% of the villages it provides housing in RAN.[29] Although we drew a 30% cutoff, almost all agencies we classify as donor-implementers are *always* both donor and implementer in our villages. Donor-implementers typically have on the ground operations with central offices in Banda Aceh (capital of Aceh), and large teams of trained people in the field. All agencies in this category are considered international agencies as well[30].

We define an international implementer, if the agency named by the village head is an international first level implementer representing a different, usually international donor in RAN. While their donors face the agency problem of monitoring the quality of aid delivered by the implementer, these implementers have international reputations at stake.

The domestic implementer category occurs when a village in our survey names an aid agency that is a domestic implementer or an agency which according to RAN is just a donor and not an implementer. As such, the underlying domestic or international donors must hire a domestic implementer. As the visible aid agency, sometimes the village head names the international donor rather than the domestic implementer— perhaps a function of greater visibility. For example, some international donors (such as religious NGOs) sent delegations for short visits to villages where their money was being spent. Some international donors and their domestic implementers are

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[29] In some cases an NGO has multiple projects in the same village. We require for at least one of those they are both the donor and implementer

[30] One organization, the Bakrie Group, is actually a domestic agency. However, unlike the many temporary local NGOs, the Bakrie Group is one of the largest Indonesian business conglomerates and is not short lived and has a reputation to take care for. Hence, we classify it into the donor-implementer category rather than including it in the domestic implementer category.

intertwined by village heads. Either their names are explicitly linked, or in one year one agency is named and in another the other is named. Common examples include NORLINK/Salam Aceh and Caritas/Mammamia. Appendix Table 1 summarizes the agency classification based on RAN.

Variables	Obs	Mean	Variable	Obs	Mean
A. Village level variables			**C. Fishermen level variables**		
Total housing aid in 09	190	199.211	Count of faults in house	643	1.036
No. of households post-tsunami	190	177.105	Count of additions in house	643	2.300
Survival rate population	188	0.749	Count of rooms	577	1.920
Mullah survive	189	0.651	Family size in 09	643	4.005
Pre-tsunami arisan group	190	0.684	Household head age in 09	640	42.923
Distance to Banda Aceh	188	67.659	Household education in 09	637	3.551
No. of houses destroyed	185	210.984	Agency is D-I	587	0.317
Dominant provider is BRR	190	0.200	Agency is BRR	587	0.104
Dominant provider is D-I	190	0.432	Agency is Int'l Imp.	587	0.210
Dominant provider is Int'l Imp.	190	0.116	Agency is Dom Imp.	587	0.370
Dominant provider is Dom Imp.	190	0.247	1st level D-I	289	0.208
Number of housing projects	190	1.947	2nd or 3rd level D-I	289	0.014
Percent centrally piped water	180	40.706	1st level Int'l Imp.	289	0.028
Number of public buildings	190	3.679	2nd or 3rd level Int'l Imp.	289	0.014
Number of Co-op buildings	190	0.516	1st level BRR	289	0.135
Percent roads paved	185	53.319	2nd or 3rd level BRR	289	0.166
Plant pines, grasses	160	0.450	1st level Dom Imp.	289	0.370
			2nd or 3rd level Dom Imp.	289	0.066
B. Project level variables			Have leakyroof	643	0.260
Subjective quality	341	2.4619	Have cracked wall	643	0.328
Objective quality	370	0.7351	Have poor foundation	643	0.207
Agency is D-I	570	0.1912	Have faulty plumbing	643	0.241
Agency is BRR	570	0.1930	Have kitchen	643	0.628
Agency is Int'l Imp.	570	0.1070	Have bathroom	643	0.890
Agency is Dom Imp.	570	0.1579	Have plumbing	643	0.782
1st level D-I	570	0.1439	Evening pray count	632	4.220
2nd level D-I	570	0.0351	Household size in 09	643	4.005
3rd level D-I	570	0.0123	Fishermen in 09	643	0.664
1st level BRR	570	0.0667	Previous boat owner	643	0.499
2nd level BRR	570	0.0982	Fishing family succession	645	0.081
3rd level BRR	570	0.0281			
1st level Int'l Imp.	570	0.0386			
2nd level Int'l Imp.	570	0.0421			
3rd level Int'l Imp.	570	0.0263			
1st level Dom Imp.	570	0.0825			
2nd level Dom Imp.	570	0.0526			
3rd level Dom Imp.	570	0.0228			