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Organization of Disaster Aid Delivery: Spending Your Donations

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Abstract

This paper examines how different organizational structures in disaster aid delivery affect house aid quality. We analyze three waves of survey data on fishermen and fishing villages in Aceh, Indonesia following the tsunami. We categorize four organizational structures based on whether and to whom donors contract aid implementation. Compared to bilateral contracting between donors and implementers, donors that vertically integrate and do their own implementation offer the highest quality housing as rated by village heads and have fewer counts of faults, such as leaky roofs and cracked walls, as reported by fishermen. However, they shade in quality as they lose dominance as the leading aid agency in a village. Domestic implementers and the government agency that was responsible for significant portions of aid delivery provide significantly lower quality aid. We also examine how the imposition of shared ownership, the primary social agenda for boat aid agencies, affects boat aid quality. We find that village and fishing leaders steer poor quality boats towards those whom shared ownership were imposed upon, often lower status fishermen.

Key words: natural disasters, tsunami, aid, disaster relief, moral hazard, social agendas, non-profit firms, organizational structures

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. In developing countries, this typically involves foreign NGO's massing to deliver aid in remote and unfamiliar areas, a difficult task. We examine aid delivery in Aceh, Indonesia following the tsunami at the end of 2004. The tsunami devastated coastal villages in Aceh, wiping out virtually 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 and social scientists would like to know. NGO reports tend to focus on quantity in delivery such as numbers of homes or people served—but not on quality. This paper examines a key aspect of the aid black box: how the organization of aid delivery chosen by donor NGOs impacts the *quality* of aid delivered.

Donor NGOs raise money from the public for general purposes and specific causes such as alleviating the devastation from a particular natural disaster. Donors can directly implement aid delivery themselves or contract aid delivery to specific types of implementers. In Aceh, we identify four organizational structures between donors and implementers. These are identified by implementer type (in italics) and are: (1) vertical integration, which we label *donor-implementer,* where an NGO donor does its own implementation in villages, (2) bilateral contracting by an international donor with an *international implementer*, (3) bilateral contracting by an international or domestic donor with a *domestic implementer* and (4) bilateral contracting by an international or domestic donor with 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 government funds and was disbanded in 2009 as planned.[1]

In examining the impact of organizational structure on aid quality we focus on the main form of hard aid, houses. The main data for analysis comes from the fieldwork and surveys we carried out in early 2005 after the tsunami and then again in 2007 and 2009. In 2009, we surveyed village heads and local heads of the fishermen's association in 199 fishing villages in 31 sub-districts in Aceh, and fishing families in 90 of those villages. We merge the village, family, and aid information from our survey with official government and international records. In particular, we use the names of the donor and implementer of each aid project as reported in the RAN (Recovery Aceh-Nias) database, a database set up

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[1] Note that the four organizational structures imply that domestic donors only contracted with domestic implementers, not international ones. Domestic donors in Aceh were small scale, often Javanese corporations or civic organizations that did not have the resources or experience to mount their own delivery or hire international implementers.

by the Indonesian government working with the UN which recorded aid delivery aspects in Aceh, to assign the organizational structure of aid delivery.

We find that the choice of vertical integration or bilateral contracts strongly affects the quality of aid delivered, specifically whether the houses are well constructed or not. 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. In bilateral contracting, international implementers fare relatively well in providing housing quality, regardless of degree of dominance. In contrast, domestic implementers and BRR provide lower quality housing. We also briefly examine boat aid quality in relation to shared ownership. Several NGOs imposed shared ownership of boats to decrease inequality within villages. We find that village leaders steered poor quality boats towards those upon whom shared ownership was imposed, often lower status fishermen.

The aid literature offers little guide as to how organizational structure affects quality of aid delivered and we believe our results are new to the literature. There is a theoretical literature on the best ways to deliver aid concerned with local government response and manipulation, focusing on issues of conditionality imposed on recipients (Collier et al. 1997, Azam and Laffont 2003, Svennson 2003, and Murrell 2002), strategic responses by recipients (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). 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. [2] By looking at one situation in Aceh, we are holding constant many of the aspects this literature examines. Unlike ODA (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, and hence provides the context to examine the impact of organizational structure on aid quality.[3]

The next section discusses the organization of disaster aid delivery. Section 3 describes the data and present descriptive patterns. Section 4 analyzes house aid delivery and Section 5 briefly examines boat aid and shared ownership. Section 6 concludes.

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[2] Wane (2004) does look at aid quality cross-countries but focuses on the relationship between aid quality and a country's degree of accountability. 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).

[3] There is a literature on NGOs, which focuses mostly on hospitals and schools and how those institutions perform (Newhouse 1970, Epple and Romano 1998, Malani et al., 2003), but the focus is not on organizational structure..

II. Conceptualizing the organizational structure of aid delivery in Aceh

Relevant to the organizational structure of aid delivery are the well established literatures on reputation (Kreps and Wilson, 1982) and on vertical integration and incomplete contracts (e.g., Joskow 2010 and Perry 1989), with more specific reference to the sub-literatures on transactions costs identified with Williamson (e.g., 1979, 1989), on property and control rights identified with Grossman, Hart and Moore (e.g., Grossman and Hart, 1986 and Hart and Moore, 1990) and on the principal agent problem applied to the theory of the firm reviewed in Holmstrom and Roberts (1998). We briefly apply concepts from these literatures to analyze the possible effects of organizational structure on aid quality.

While we focus on the relationship between donors and implementers, a third set of actors, builders chosen by implementers, are important in conceptualization. A builder has a contract with an implementer to undertake construction of so many houses in a village. Usually, the basic house design is imposed by the implementer. The builder normally buys materials and hires and supervises carpenters, plumbers, day labor and the like. Not only are these contracts between implementers and builders incomplete, enforcement in court is costly, given the slow working of the local legal system and the potential for corruption in Indonesia. Thus work proceeds in stages, with 2-4 staged payments. Local village pressure including intervention by village and district officials may offer some enforcement and dispute resolution. But the potential for contract hazards is high. Construction is site and use specific, meaning the dwelling units can't be moved once started and can't readily be put into other uses. This leads to hold-up problems. When construction is partially complete more money may be demanded in an attempt to expropriate quasi-rents. This problem may be mitigated by contracting houses in stages- the 1st ten, 2nd ten, and so on. Thus a crucial part of the implementer's job is to hire more reliable builders, agree on the parameters for house construction, design a contract with them, monitor work, try to enforce the provisions of the contract, and negotiate changes as difficulties arise. Their ability to do that may depend on experience in contracting in general and in Aceh in particular. But we focus on their incentives to supervise the builders.

When donors contract with implementers they face contract hazards. The implementer in a village also has site and use specificity. To fire an implementer throws into doubt the relationships and contracts developed with builders. It may mean abandoning work started, or involve costly negotiation with the new and old implementers. Thus implementers can also halt proceedings, hold-out, and attempt to extract quasi-rents from the donor, as well as imposing delay and bargaining costs. Additionally, there is the potential for the implementer to be in league with builders to pocket money in the purchase of shoddy materials and hiring of phantom workers. As noted above, it may be hard for the donors to enforce contracts in local courts. One incentive to perform is to maintain reputation if the implementer anticipates repeated business with potential donors in the future.

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For the situation at hand, it would seem that vertical integration dominates bilateral contracting. In principle, vertical integration removes contract hazards between donor and implementer and makes conflict resolution much simpler, although there are caveats in the literature. [4] Thus, we might think that donor-implementers do better than donors who hire implementers where agency issues remain. However, international implementers have incentives to perform because they face international reputational costs in the context of the repeated game of contracting in aid disasters. Domestic implementers are less likely to face that incentive both because they don't operate internationally and because in Aceh many were short-lived. Thus we might expect more contracting hazards and lower quality housing with domestic implementers than international ones.

In assessing domestic implementers, there could be a distinction between what type of donor hires them. International disaster aid donors have little potential for post-aid relationships with domestic implementers absent frequent major domestic disasters and would have a hard time pursuing implementers in local courts. For domestic donors, there may be some chance of post-aid relationships with domestic implementers, and some possibility of court enforcement. However, in the results we see no difference in performance of domestic implementers hired by domestic versus international donors. Also, domestic donors do not hire international implementers, perhaps for political reasons, high contracting costs (language and culture differences), and no hope of ex post court enforcement once international implementers have delivered aid and left Aceh. Finally, there is the government entity, in Aceh's case, BRR. Government entities are even more difficult to bring to local court, are a big player which may not respond to pressure from local leaders, and has no reputational concerns since it was defined to be short lived. [5] The main goal of this paper is to quantify the resulting quality differentials in aid delivered by organization type.

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[4] As Williamson (1975, 1989) points out vertical integration doesn't necessarily dominate bilateral contracting. Costs of vertical integration involve governance issues such as bureaucratic hierarchy and employee incentives. Bilateral contracts are more likely arms-length. Vertical integration invokes personal relationships within the firm and the potential for subversion of firm objectives and application of incentive schemes. The employee on the ground in Aceh has the potential to shirk or engage in corrupt practices because of problems in executing hypothetical reward/ punishment schemes in the face of inter-personal relationships within the firm.

[5] If there is pattern of sequential dominance among the four types of agencies, why do we see four types of arrangements in practice? First for donor-implementers versus international or domestic ones, to operate as a vertically integrated unit, donor-implementers had to incur fixed costs of setting up operations in Aceh, a remote and isolated region. Overcoming these fixed costs requires a larger scale operation. For small donors, the fixed cost hurdle means bilateral contracting may be a better choice. Small donors will hire either domestic or international implementers who have incurred the fixed costs themselves to run operations in Aceh. For small scale international donors, then, why bilaterally contract on small amounts of aid, knowing quality might suffer? One answer is marketing: some international NGOs may have felt pressure in the fund raising market to say they were helping in such a major internationally visible disaster situation. But they had little expertise in Indonesian operations, so they made a symbolic small scale response.

III. The data, context, and descriptive patterns in the data

III.1 The data

We carried out extensive fieldwork in early 2005 after the tsunami and then again in 2007 and 2009, with survey teams in the field for many months. 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 away from Banda Aceh, the capital (see Figure 1). 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 operations of NGOs, quality of aid, and democratic evolution. We also surveyed fishing families, following a panel of about 635 fishing families in 90 of the villages we surveyed. The surveys cover many aspects of family and village circumstances; here we focus on questions relating to aid delivery in both the village and household surveys. More detailed aspects of the surveys are presented in the Online Appendix.

In order to classify the aid agencies, we focus on agencies reported by the village head in 2009 as having delivered aid in their villages. Each village head is asked to name 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. However, village heads couldn't really tell us about donor, implementer, country, religious and the like status of these agencies. For these 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[6]. 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 map each named agency into one of the four organization types, identified by type of implementer.

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.[7] 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, and large teams of trained people in the field. All agencies in this category are

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

[7] 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

considered international agencies as well[8]. In bilateral contracting, 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 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.[9] The Online Appendix lists the house and boat aid agencies and their classification based on RAN and Table 1 provides the summary statistics of the main variables in our sample.

III.2 The context

Fishing 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 the capital, Banda Aceh. Destruction is massive. Less than 50% of the population survived in the 104 villages around Banda Aceh surveyed in 2005. In the expanded set of villages, 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. 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. By late 2007, the massive aid process had accomplished what it intended—to replace the entire physical capital stock. Yet, given the massive response there was money left to spend. More public

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[8] 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.
[9] Common examples include NORLINK/Salam Aceh and Caritas/Mammamia.

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%, motivating notions of excess provision. Table 1 of the Online Appendix provides a more detailed overview of the destruction.

III.3 Patterns in the raw data

The raw data indicate that the four types of implementers operated differently and delivered different qualities of aid. We start with operations. Table 2 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. In villages with multiple housing projects, each agency would build the number of houses it committed to on specified plots. Table 2 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.[10] Additionally, 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 overall provider, but operates on a small scale in most villages. 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 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. Note for later reference that domestic implementers at 45% [16%] compared to international ones show a modestly greater relative presence in villages they serve, although they are a more diverse group. We identified 28 different domestic implementers delivering housing in our villages compared to 12 international ones.

In the raw data 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 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

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[10] 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.

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, for a smaller sample of villages, 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 some 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 contracting problems. 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, although in econometric results they will score better than domestic ones.

IV. Empirical Evidence on the Quality of Housing Aid
IV.1 Base specification and covariates
We have two base specifications. First is

$$y_{pv} = c + \sum_{t} \beta_t D_{tpv} + \gamma X_v + \Lambda_k + \varepsilon_{pv}, \qquad (1)$$

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 and fishermen's subjective assessments of problems related to construction. 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

$$y_{pv} = c + \sum_{t} \sum_{r} \beta_{tr} D_{tpv} \cdot r_{pv} + \gamma X_v + \Lambda_k + \varepsilon_{pv}, \qquad (2)$$

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 measures of social capital. We include two social capital measures: the pre-tsunami existence of *arisan* groups, or rotating savings and credit associations (RoSCA), and whether the mullah, the spiritual leader of the village, survived the tsunami, providing continuity in village spiritual leadership.[11] 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).[12] When we analyze individual fishermen's assessments, we will add family controls as well. Standard errors are always clustered at the village level.

We do not include village fixed effects because many villages have just one provider and many agencies operate almost exclusively at one level or another. Village fixed effects would eliminate effective variation in implementer types. We control for cultural-institutional differences across villages with fixed effects for 4 districts. In principle, a better control would be the 31 sub-district (*kecematen*) fixed effects. 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. When we use the larger project level sample, we report and discuss results with and without sub-district fixed effects.

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 3 looks at subjective quality ratings by the village head of each project. The basic results are in column 3, where we control for base village characteristics and district fixed effects. For implementer-type effects, in column 1 we control for the provider for each specific project, regardless of order as in equation (1). Donor-implementers and international implementers bring similar positive effects, compared

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[11] In Aceh, 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). Freire, Henderson and Kuncoro (2011), finds that village traditions of volunteer labor are better maintained in 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. Greater social capital could be associated with more cohesion in villagers dealing with implementers and builders. We also note that village size and survival rates may affect social cohesion.

[12] 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.

to domestic ones or BRR. In column 2, which represents equation (2), 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 projects. Thus, in the end we focus on column 3 where we constrain all 2nd and 3rd level project pairs to have the same coefficient.[13]

The pattern we see in columns 2 and 3 is that, relative to the baseline 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 into quality as their prominence in a village fades. However for international implementers there is no quality decline as they lose dominance; they operate and monitor in villages to offer good quality house everywhere. For donor-implementers, it seems care in dealing with contractors declines as their dominance declines, a startling finding which robustness is explored in the next table.

Column 4 shows that village characteristics without aid agency controls have no significant effects on quality. Columns 5-7 show that, compared to column 3, implementer type effects are not influenced by any observable village characteristics. Column 5 additionally controls 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. These have no effect on quality and do not change coefficient estimates of the other variables. In column 6, 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.

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[13] 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 matters. 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.

We can't prove there are no unobservables that matter, but the absence of any relevance of observables in affecting quality is an important consideration. Conditional on type, agency housing quality is not influenced by any village characteristics which might be matched to agency type. We explore this aspect further in section IV.4.

IV.2.2 The donor-implementer twist

An intriguing aspect of Table 3 is that donor-implementers appear to lower quality once they lose dominance. Here we show there appears to be a steady decline in quality as donor-implementer dominance wanes. We first took the column 2 Table 3 specification, removed the constant term, added indicator variables for each project level by type of implementer, and then for all 1st level projects by implementer type we added that indicator interacted with the fraction provided by other projects in the village. While fractions are endogenous, in the model in Henderson and Lee (2012) quality is only affected by unobservables through its effect on fractions provided. The only fraction variable across all implementer types that is significant is the one for donor-implementer.[14] We thus focus on a restricted, "preferred" specification in column 1 of Table 4, based on column 3 of Table 3.

In column 1 of Table 4, 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. Do these effects reflect agency policies per se? We worried that they might arise because of differences in the composition of 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 usually 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 4 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) appeared who routinely operated at different levels in different villages. The results in column 3 are not highly significant given the small sample but the coefficient patterns are consistent with columns 1 and 2.

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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].

Composition does not seem to be driving the results.[15] Finally, we note that replacing district by sub-district fixed effects in Table 4 has no significant effect on outcomes.[16]

Given that the outcome variables in Tables 3 and 4 are ordinal variables, we also implement an ordered logistic regression model. The ordered logistic regression results are virtually identical to the OLS results. The same variables are statistically significant in each corresponding specification. Though an ordered logistic regression can be more suitable than an OLS regression for ordinal outcome variables, it also relies on the proportional odds assumption, the assumption that the relation between, for example, the two groups of 1 and above 1 is the same as the two groups of below 3 and 3. We present the OLS results here and direct the readers interested in the ordered logistic regression results to the Online Appendix.

IV.3 Individual level analysis: Quality ratings by fishermen

Are the findings from the village level data confirmed by individual micro data, for the sub-sample of 90 villages where we survey fishermen? We have several hundred fishing families who received a house, name an agency we can identify and categorize, and have corresponding information on different house quality dimensions. Before starting we note that the basic results in column 3 of Table 3 are maintained in the sample of 90 villages (Henderson and Lee 2012, Appendix 4, column 3) and that the 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 have two samples, although we rely more on the second. First are 529 families, where we assign agency type 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 any lagoon, villagers are sometimes confused about exact foreign names and what actual implementer was responsible for supervising the contractor who built their

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[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.

[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.

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 tenuous.

Keeping BRR as the baseline, Table 5 reports Poisson regressions on fault counts and probit regressions for each individual fault. The basic village variables from before including district 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 are included as controls. None of these family and village controls are significant and we don't report their coefficients in this table. For total faults, column 1 presents 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.

Columns (1a) and (1b) report respectively for the larger and then the better matched samples. Column (1c) for the smaller sample removes all village or family controls and fixed effects to show these have no impact on implementer types results. 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 results are statistically weak perhaps because of their small representation in the sample. The column (1a) estimate is small, consistent with measurement error in typing. In columns (1b) and (1c), for international implementers reductions are 81% and 91% respectively. 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. Finally, we note that the small cell counts make it impossible to confirm the 1st versus 2nd and 3rd level projects effects we found for village heads in Tables 3 and 4; results are roughly consistent but noisy.

In Table 5, columns 2-5 report probit regressions on whether the house has a leaky roof, cracked walls, poor foundation, or faulty plumbing, for the smaller better matched sample. 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. 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

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[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.

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.4 Examination of selection

We believe the empirical results are indicative of the causal impact of organizational type on aid quality. The identifying assumption is that the chaotic and urgent context of disaster aid delivery after the tsunami generated a quasi-random assignment of aid agency types to villages. However, we cannot simply rule out the potential for selection on unobserved variables. For example, a diligent and persistent village head monitoring delivery may get better quality out of any implementer and associated builders, through nagging and development of inter-personal relationships. If there is matching in the sample between the degree of village heads' persistency and types of implementer, estimates could be biased. Suppose donor-implementers were more responsive to local pressure to hire better builders and to monitor them carefully. If persistent village heads perceived this and sought out that agency type, then part of the estimated effect will be due to unobserved village characteristics, not the quasi-random assignment of type. A natural way to proceed would be to correct for this problem with a selection correction or IV strategy. In general there are no observables that meet the exclusion restriction a priori.[20] Thus we proceed as follows. We first discuss why selection on agency type was particularly unlikely in the context of Aceh in more detail. Next, we look for evidence of matching and point out that a myriad of village observables have no individual effect on quality. Lastly, we look at potential degrees of selection and associated bias following Altonji et al (2005).

First, because of 30 years of insurgency and military occupation, Aceh was an isolated province in Indonesia with no foreign and little domestic NGO presence prior to the tsunami. Village heads had no ex ante information about what types of agencies would deliver better or worse quality aid or be responsive, and no way to gather objective information on agency attributes right after the tsunami, or even to be aware of the organizational structure behind an implementer. 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. NGOs had no prior information about villages. Regional maps of villages were highly inaccurate, and centralized information on village characteristics almost non-existent. Furthermore, even if some wily village heads could successfully seek out agency types that were more responsive, the heads who negotiated contracts were typically no longer heads at time of aid delivery. Because of the settling of the 30 years insurgency in Aceh, village democracy in Aceh was finally imposed at the beginning of 2006,

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[20] One possibility came from the idea that individual NGOs tend to cluster in sub-districts to reduce costs of operation. So using RAN, we constructed measures of the extent of clustering by agency type (outside the own village) in a sub-district; but resulting instruments were too weak instruments to be useful. Part of the weakness occurs because actual clustering is at the individual agency level, not at the type level.

years after the rest of Indonesia. In most villages, the village head was a traditional head chosen from village elites. Most of the traditional heads did not survive elections and were replaced by younger and better educated heads chosen by the general village population (Freire, Henderson, and Kuncoro, 2011). Only 36% of these unelected heads were still in office by 2007 and 12% by 2009. Most were removed in elections in 2006 and early 2007, with most aid delivered in 2007.

Second, we look at the match between the housing project's implementer type and observable village characteristics in a multinomial logit framework in Table 6. 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, 5 of which depict internal village characteristics, 2 of which relate to village head characteristics, and the last being distance to Banda Aceh. District (*kabupaten*) fixed effects are included as in previous regressions. Although the overall associations are significant, only one of the 48 marginal effects (including those for fixed effects) is significant at the 5% level.[21] Villages with a pre-tsunami *arisan* group are 18% more likely to get a donor-implementer and about 10% less likely to get an international implementer or domestic implementer. It could be that having an *arisan* group (RoSCA) represents a village as having greater social capital appealing to donor-implementers. Of course for selection effects, that only matters if social capital also influences agencies to build better houses than they otherwise would and Table 3 suggests not.

We then turn to an econometric technique that helps gauge the degree of potential bias that could arise from the unobservables, a method proposed by Altonji et al. (2005) to the multinomial treatment case. By conditioning the error term and the index of observable variables in the outcome equation to have the same impact on the agency type variables, we can estimate the selection bias in OLS. The ratio of the original OLS estimate to this estimated selection bias shows how large the selection on unobservables relative to the selection on observables would have to be to explain away the entire agency effect. Section 6 of the Online Appendix explains the underlying econometric procedures and Table 7 presents the results. The first row restates the OLS coefficient estimates reported in column (3) of Table 3; the second row presents the implied selection bias in the agency type effects with bootstrapped standard errors; and the last row is the ratio of the OLS estimate to the implied bias, or how large the selection on unobservables relative to the selection on observables would have to be to explain away the

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[21] When we exclude the district fixed effects we find that distance to Banda Aceh has a significant relation with the agency types. The district fixed effects in Table 9 are masking a distance effect. Domestic agencies and BRR appear to have an aversion to operating in more remote locations. We don't see that as a match affecting 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.

entire agency effects. For international implementers the negative implied bias in row 2 of -0.078 is small and statistically indistinguishable from zero, resulting in a large ratio in row 3. The negative sign implies that the selection bias impacts the outcome in the opposite direction to the international implementer effect, though the standard error in row 2 is large. For domestic implementers we get a small ratio in row 3, but the original OLS estimate is also small. Lastly, while the point estimate of the bias, 0.549, in row 2 for donor-implementers is large relative to the OLS estimate in row 1, the standard error is also large, as are standard errors for all implementer types. This makes it difficult to accurately assess the role of unobservable vaiables, but overall Table 7 results indicate that the donor implementer and international implementer effects we find in OLS are likely to be valid. [22]

IV.5 Delivery of other village built capital

In Henderson and Lee (2012) we also showed that villages where the main house agency was a donor-implementer also got, ceteris paribus, a higher count of public buildings given in aid, a higher fraction of roads which were paved and more plantings along the shoreline to forestall erosion, in comparison to villages where BRR or generally international implementers were the main agencies. However, as a counter-point to their dismal house aid results, domestic implementers as a group did as well or better than any other group on these dimensions. There are two main points. First the dominant house agency in a village affects other forms of delivered aid although they are not providing that aid, because they are heavily involved in village planning and are the one agency that has a sustained presence in the village. Donor-implementers often strive to ensure wholesale village recovery and domestic implementers may be better connected to domestic officials and government agencies which were more responsible for delivery of village public goods.

V Imposition of socio-political beliefs: boat aid

Another aspect of aid outcomes we are interested in is the high failure rate of boats given in aid in Aceh. There are two time dimensions to failure. The first is immediate failure as reported by the local head of the fishermen's association. 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

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[22] Altonji et al. (2005) point that when the ratio in row 3 is greater than 1, one can have faith in the OLS estimates because selection on unobservables is likely less than selection on observables. Given that most of our covariates are statistically estimated at zero in equations (1) and (2) of Section 6 of the Online Appendix, one may wonder why the ratio is not larger than the 0.55 we get. One of the assumptions in the Altonji et al. procedure is that no single variable dominate the distribution of the outcome or treatment variable. This is because the covariance between $X\gamma$ and $X\beta$ can be large when a few coefficient estimates in γ and β dominate the other coefficient estimates in magnitude. In our case, the coefficient estimates on the pre-tsunami *arisan* variable in equations (1) and (2) of Section 6 of the Online Appendix, though statistically not different from zero, were larger than the other coefficient estimates rendering a seemingly large correlation between ε and u.

most boats had been given, the overall abandonment rate as reported at the village level was already 22%. The second dimension is boats that were initially usable but fell apart after a few months of usage, in a context where traditional boat last at least 5 years. We estimate that by 2009 at least 30-40% of boats had failed either initially or in the subsequent 2 years. We cannot identify comprehensively implementer type for boats, because most boat aid is not reported in the RAN database. As such, implementer type is not the focus in our analysis of boat aid. We do note from the on-line Appendix that major players like Mercy Corps, Church World Services, and the International Red Cross had next to no failures reported, while Oxfam and the International Medical Corps, as well as BRR had failure rates in excess of 40% between 2007 and 2009.

In this section we discuss boat aid quality in relation to a unique aspect of boat aid delivery, shared ownership. Certain aid agencies imposed shared ownership on a substantial fraction of aid boats, to try to move away from the traditional owner-crew social and economic structure. This covers an aspect of aid which is discussed more in Henderson and Lee (2012) and which is important: the attempted imposition of by aid agencies of social agendas and values on villages and fishermen, by imposing strings on aid delivered.

We use the individual fishermen data, which cover 88 villages in the estimating sample. These data allow us to tease out the sharing-failure association in detail. 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 for boats as identified in RAN are a small group. Figure 3 illustrates the agenda of shared ownership and its relationship to 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%). Also, regardless of failure, joint ownership fails to persist with only 20% still sharing in 2009. While the high failure rate plays into that, among surviving boats that were initially shared in 2007, only 35% still had shared ownership in 2009.

Why is the failure rate among shared boats so high? 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 the village fishing leaders distributed the aid boats. The first question we explore is whether shared ownership is random across fishermen or targeted. We assume 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. The next question we examine is whether the fishing leaders who allocated boats further thwarted the sharing agenda by assigning poor quality boats to shared ownership.

In Table 8 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. Sharing to some extent seems to have been imposed on lower status fishermen, who had poorer claims to ownership. Across villages, sharing increases in villages with higher initial social capital (*arisan* group), which may have been more willing to accept the equality agenda underlying shared ownership. Sharing declines as boat aid rises in a village, suggesting that in villages with fewer aid boats relative to need, sharing was more likely to occur.

In terms of aid agencies which favored sharing, 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 is in one district. TGH which gave 29% of boats with only a 36% share rate is entirely in another district. As Table 8 shows, IMC has significantly more and TGH significantly less sharing compared to the base of small, ungrouped boat NGOs. Given all agencies besides IMC and TGH appear infrequently, we tried other groupings. Getting a boat from a boat donor-implementer identified in RAND (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.

In columns 3 and 4 of Table 8, we turn to failure of aid boat, 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 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. 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, to lower status fishermen, while better ones were put aside for sole ownership. Presumably, this was not what donors intended.

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 8, the two usage variables have tiny coefficients and are insignificant; other results are the same as in columns 3 and 4. Failed boats were just badly built.

V. 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 that 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.

We also investigate aid quality in relation to shared ownership of 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.

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 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. And the choices affect the quality of life in villages subject to natural disasters in developing countries.

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Figure 1. Map and survey area
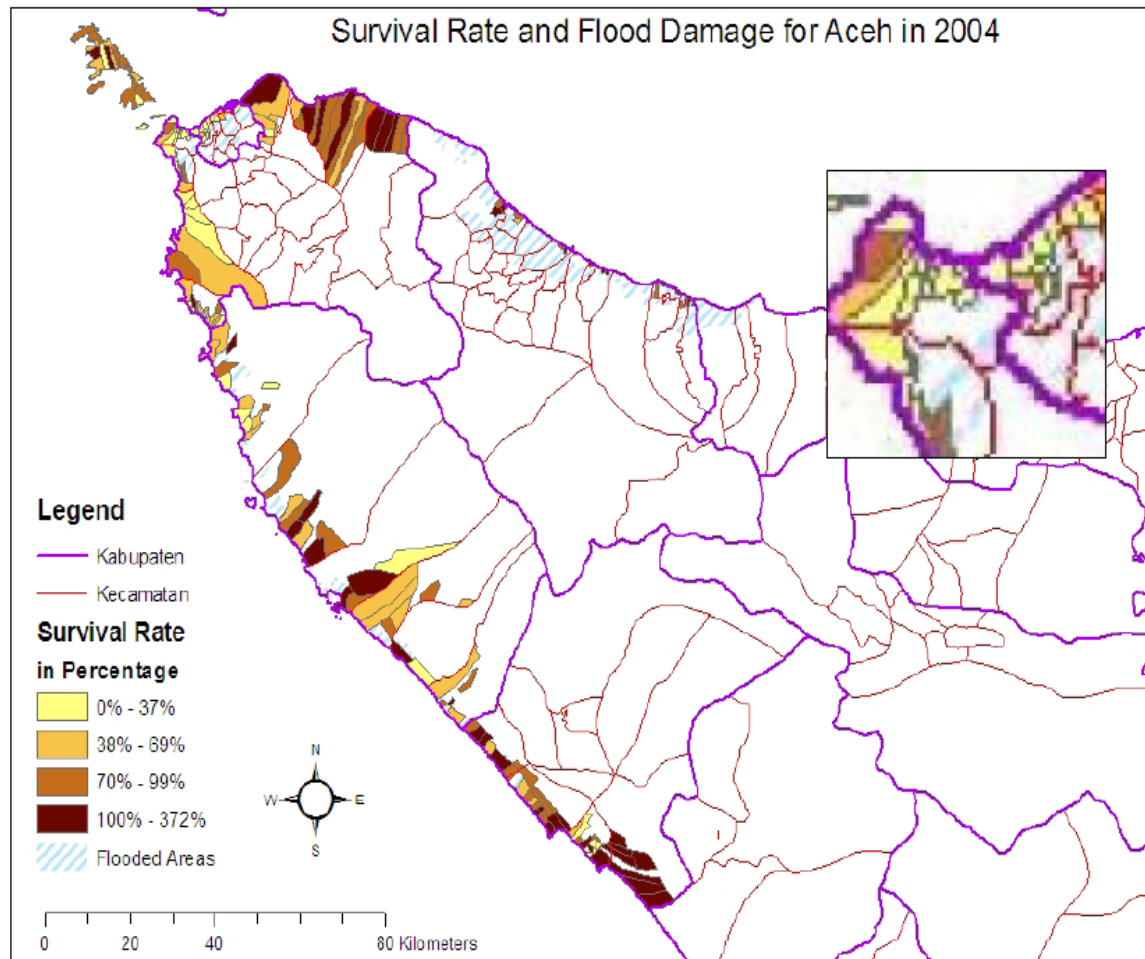
Notes: The figure shows a map of the survey area, with a blow-up (right side in figure) of the Banda Aceh area (upper-left part of coastal area). [1] We cover all villages in three contiguous districts (Banda Aceh, Aceh Jaya, and Aceh Besar) going south and north-east of the capital Banda Aceh. In addition 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.

Figure 2. Housing Aid: Quality by types of aid agencies, village head and fishermen 2009


Avg. village subjective rating

Avg. count of faults by fishermen
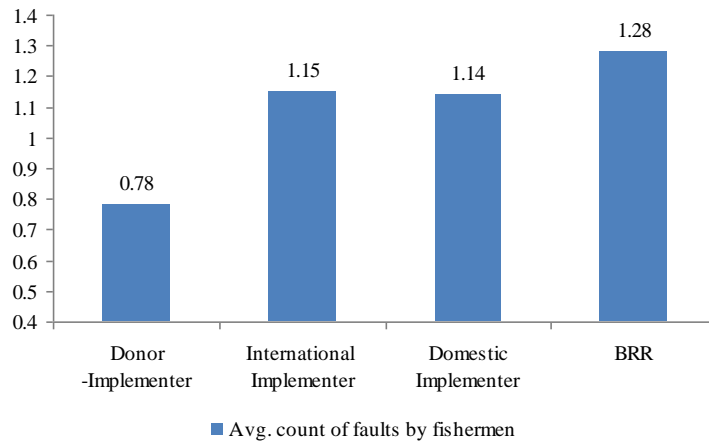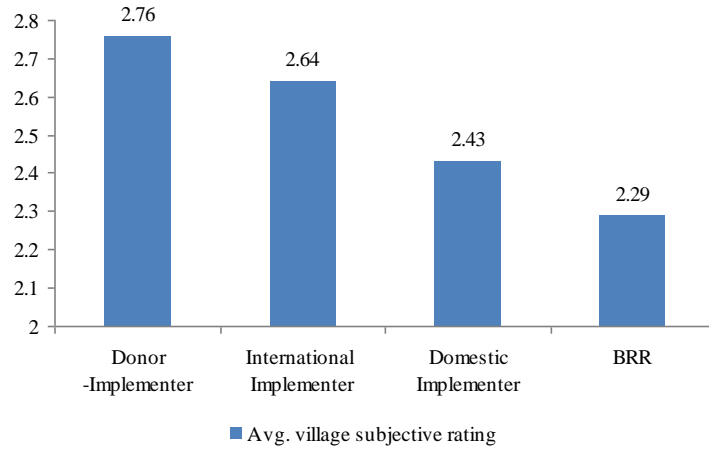
Figure 3. Boat aid: Shared ownership and boat failure, fishermen 2009

% abandoned because of poor quality   Still sharing in 2009
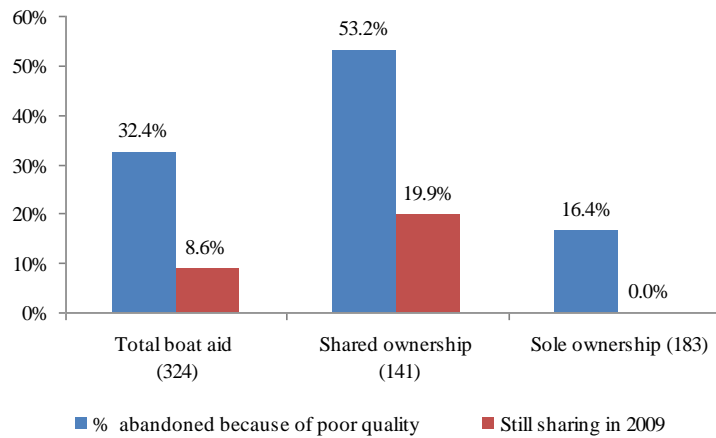
Table 1. Summary statistics of the survey data

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			

Table 2. 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 3. Quality of housing

Dependent Variable:	Subjective Quality						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(no. households post-tsunami)	0.00713	0.00430	0.0140	0.00822	-0.00185	0.0609	
	(0.0608)	(0.0582)	(0.0592)	(0.0648)	(0.0601)	(0.0852)	
Survival rate population	-0.0913	-0.103	-0.110	-0.0790	-0.0929	-0.0906	
	(0.0920)	(0.0871)	(0.0875)	(0.0933)	(0.0851)	(0.0843)	
Mullah survive	0.130	0.157	0.154	0.117	0.146	0.107	
	(0.0942)	(0.0962)	(0.0956)	(0.0996)	(0.0943)	(0.110)	
Pre-tsunami arisan group	0.109	0.0928	0.0930	0.124	0.0730	0.106	
	(0.101)	(0.0994)	(0.0981)	(0.107)	(0.0953)	(0.0949)	
Ln(distance to Banda Aceh)	0.0915	0.0743	0.0783	0.0983	0.104	0.0711	
	(0.103)	(0.102)	(0.0995)	(0.106)	(0.0983)	(0.260)	
Ln(no. houses destroyed)	-0.0261	-0.0300	-0.0328	-0.0265	-0.0329	-0.0495	
	(0.0347)	(0.0322)	(0.0327)	(0.0381)	(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	0.116	0.163	0.153	0.064	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 4. 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 3. Robust standard errors clustered at the village level are in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5. 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 3, household size, age, and household head education level are included. Columns (1a)-(1c) report Poisson regression results. 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 6. 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)	0.0360	-0.0191	0.0167	-0.0336
	(0.0474)	(0.0314)	(0.0391)	(0.0453)
Survival rate population	0.0352	0.0257	-0.0233	-0.0376
	(0.0657)	(0.0494)	(0.0702)	(0.0802)
Mullah survive	-0.00364	-0.0148	-0.0286	0.0470
	(0.0590)	(0.0510)	(0.0546)	(0.0568)
Pre-tsunami *arisan* group	0.181***	-0.1000*	-0.0935	0.0122
	(0.0580)	(0.0572)	(0.0600)	(0.0614)
Ln (distance to Banda Aceh)	0.0254	0.0357	-0.0646	0.00349
	(0.0589)	(0.0486)	(0.0530)	(0.0628)
Ln (no. houses destroyed)	-0.0205	0.0192	0.0355	-0.0341
	(0.0310)	(0.0246)	(0.0289)	(0.0276)
Village head survive	0.0397	-0.0736	-0.0123	0.0463
	(0.0714)	(0.0677)	(0.0698)	(0.0721)
Surviving village head graduated from high school	-0.0501	0.0645	0.0479	-0.0623
	(0.0638)	(0.0582)	(0.0620)	(0.0664)
Kabupaten dummies	Yes	Yes	Yes	Yes
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 7. Amount of selection on unobservables relative to selection on observables required to attribute the entire agency effect to selection bias

Treatment variable:	Donor Implementer	International Implementer	Domestic Implementer
OLS estimate	0.300	0.312	-0.033
	(0.095)	(0.101)	(0.12)
Implied bias under equality of selection	0.549	-0.078	-0.381
	(0.416)	(0.400)	(0.396)
Ratio of estimate to bias	0.55	-4.00	0.09

Notes: Standard errors are in parentheses. Bootstrapped standard errors are reported for the implied bias estimates. The ratio of estimate to bias is the ratio of selection on unobservables relative to the selection on observables needed to explain away the specific implementer type effect.

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