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Migration due to the tsunami in Sri Lanka - Analyzing vulnerability and migration at the household level

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Abstract

To achieve a better understanding of the diverse vulnerabilities of different social groups affected by the tsunami in December 2004 in Sri Lanka, a survey of 500 households in the Sri Lankan urban area of Galle has been conducted in cooperation with several institutes under the direction of the Institute of Environment and Human Security of the United Nations University (UNU-EHS). An important aim of the project is to analyze the determinants and effects of the migration decision at the household level to be able to support the development of appropriate prevention, assistance and resettlement policies.

In this paper, we first develop a framework for analyzing the factors which have an impact on the household's decision to stay in or migrate from a tsunami-affected, risky area. By using a logistic regression analysis, this framework later provides a basis for the examination of the significance of each factor. In a second step, it is analyzed to what extent the same factors determine the probability of a household to receive financial, material, or psychological support.

The results of the regression analysis indicate that especially households who have been affected by the tsunami to a great extent (e.g. by a high number of dead, missing or seriously injured household members), or households who have had bad experience with the sea already before the tsunami are more likely to migrate than others. Having relatives at a possible new place as well as having received financial and/or material support like tents or tools also both have a "pushing" impact on the household's decision to leave the area. This implies that most current support schemes encourage people to leave the high-risk areas. Factors which decrease a households' likelihood of migration are higher education, good access to information and the ownership of land and house, as well as support programs providing households with building material.

Kurzfassung

Um die unterschiedlichen Ausprägungen von Vulnerabilität der verschiedenen sozialen Gruppen Sri Lankas, die im Dezember 2004 von einem Tsunami überrascht wurden, besser verstehen zu können, wurde eine Befragung von 500 Haushalten im eher städtisch geprägten Distrikt Galle durchgeführt. Koordiniert wurde die Befragung vom Institute of Environment and Human Security der United Nations University (UNU-EHS) in Kooperation mit verschiedenen Instituten. Erklärtes Ziel dieses Projektes ist es, die Determinanten und Auswirkungen der Migrationsentscheidung auf Haushaltsebene zu analysieren, um die Entwicklung angemessener Strategien zur Prävention, Unterstützung und Wiederansiedlung zu unterstützen.

Zuerst wird ein Rahmen für die Analyse der Faktoren entwickelt, die bei der Entscheidung eines Haushaltes, in einem vom Tsunami zerstörten und gefährlichen Umfeld zu bleiben oder dieses zu verlassen, eine Rolle spielen. Mit Hilfe einer logistischen Regressionsanalyse bietet dann dieser systematische Rahmen die Basis für die Untersuchung der Signifikanz der jeweiligen Faktoren. In einem zweiten Schritt wird untersucht, in welchem Maße die gleichen Faktoren die Wahrscheinlichkeit bestimmen, dass ein Haushalt finanzielle, materielle oder psychologische Unterstützung erhält.

Die Ergebnisse der Regressionsanalyse zeigen, dass die Haushalte, die in besonderem Maße vom Tsunami betroffen sind (z.B. durch eine hohe Anzahl von getöteten, vermissten oder schwer verletzten Haushaltsmitgliedern) oder Haushalte, die schon vor dem Tsunami negative Erfahrungen mit dem Meer gemacht haben, eher migrieren als andere Haushalte. Leben bereits Verwandte an einem möglichen neuen Wohnort bzw. wurde finanzielle und/oder materielle Unterstützung in Form von Zelten oder Werkzeugen geleistet, so ist es wahrscheinlicher, dass die Haushalte sich für ein Wegziehen von der alten Umgebung entscheiden. Das lässt den Schluss zu, dass die meisten gegenwärtigen Unterstützungsprogramme die Menschen eher dazu ermutigen, ihr unsicheres Umfeld zu verlassen. Faktoren, die die Migrationswahrscheinlichkeit eines Haushaltes eher herabsenken, sind eine höhere Bildung, ein guter Informationszugang und der Besitz von Land und Haus, inklusive das Erhalten von Baumaterial.

1 Introduction

On 26 December 2004, the tsunami hit some coastal areas of Sri Lanka. As a result, at least 31,000 people were killed and about 500,000 people displaced (UNDP, 2005; ICRC, 2005). To gain a better understanding of the various vulnerabilities of different social groups affected by the tsunami in Sri Lanka, a survey of 500 households has been conducted. The survey forms part of a research project led by the United Nation University Institute for Environment and Human Security (UNU-EHS) in cooperation with the University of Colombo, the University of Ruhuna in Sri Lanka and the Center for Development Research (ZEF).

The design of appropriate prevention, assistance and resettlement policies requires improved information on the impact of the tsunami and why some vulnerable households choose to return to high-risk areas while others relocate to lower-risk areas. Therefore, one of the components of the project being investigated in a joint effort by UNU-EHS and ZEF aims at analyzing the determinants and effects of the migration decision at the household level.

Due to the tsunami, 83% of the households indicated that they suffered no or only minor physical injuries, 8% of the respondents reported about serious injuries and hospitalization, while close to 9% of the respondents lost or still miss family members. With respect to house damage, 29% of the houses in the survey area were totally destroyed. The household survey revealed that out of the 500 interviews, 13% of the households currently live in temporary housing from where they are planning to move in the near future again, and only 2% found a new permanent residence. Most of the households interviewed (85%), however, returned to the place where they lived before the tsunami, and almost 75% of the households even still occupy the same house as before, although quite a few of those households responded that their houses were heavily damaged. However, of these 390 households who returned to the tsunami-struck area, almost 11% indicated that they are planning to move to another area in the near future, most of them to another city close by, and another 22% said that they do not know what to do. A total of 207 households (41% of the full sample) intend to stay in the area, whereas a total of 117 households (23 %) have the intention to migrate permanently.

Only a few studies have investigated the impact of natural disasters on the incidence of migration. While the research group ‘Espacios Consultores Asociados’ (ECA) (2004) found that migration increased after hurricane Mitch in the affected Central American countries, Paul (2005) did not find any hints for an increased migration after the occurrence of the April 2004 tornado in Bangladesh. Thus, it seems that migration after a natural disaster may obviously depend on regional and cultural factors, and that it is important to analyze the migration decision and its driving factors in more detail.

Further econometric analysis of the survey will reveal to what extent the decision of a household to move to lower-risk areas will depend on observable factors like the perception of the safety level at the place of origin and the potential place of reception, respectively; the income and standard of living at the place of origin compared with the place of reception; the migration and information cost, and the existence of social networks; or certain household characteristics like education, or age.

The results will help to understand why people decide to stay despite the insecurity they face in disaster-prone areas. Clarity would be given on some interesting questions like: are the richer people moving because they can afford to move – and poor people will stay behind? Or will the richer households stay because they would have too much to give up? To what degree does information provision affect the displacement decision? The analysis conducted by ZEF and UNU-EHS will also yield policy recommendations with respect to the relative importance of and need for different state programs like short-term assistance programs (food etc.), microfinance programs, capacity building and employment programs, early warning systems, or resettlement programs.

2 Theoretical Framework for the Analysis of the Migration Decision

2.1 Economic Migration Theories – Development and State of the Art

The beginning of economic migration theories and migration research in general can be dated back to the 1880s when the demographer Ernest George Ravenstein published two articles in the "Journal of The Royal Statistical Society" about the so-called "Laws of Migration". In these articles Ravenstein primarily explained the phenomenon "migration" with the natural disposition of human beings to improve their material living conditions. Consequently, the existence of places with different levels of development and different wage levels causes the migration of what he called 'surplus population' from the places with low salary levels to places with higher salary levels (Ravenstein 1889: 286-289). Ravenstein (1889) also introduced an element of migration research which is very momentous in contemporary migration research, namely the idea of "push" and "pull" factors. Push factors can be certain economic, political, social, violent or (like in our case) environmental or ecological circumstances at the place of origin which put pressure on people to migrate, whereas pull factors are incentives at a possible place of reception (Lee 1966: 49-56).

However, Ravenstein (1889) did not adequately consider factors like migration costs, the probability of employment at the place of destination, or the discount rate. The economic research on migration incorporated these factors only in the 1960s with the upcoming of the human capital theory. This theory which was particularly developed by Gary S. Becker (1964) introduced the idea that all the above-named factors depend on individual characteristics. For example, it was shown that individuals with lower levels of risk aversion are more likely to migrate than others. Thus, the authors of the human capital theory (e.g. Becker 1964; Todaro 1976; Mincer 1974) emphasized that potential migrants could no longer be seen as a homogenous group.

From the 1980s onwards, new migration theories were developed. On the one hand, these focused on the term 'information costs' which was a less considered variable until then. Among other things, it was shown that a basic premise of migration is the fact that the costs for staying at the place of origin have to be lower than the basic information costs. Interesting in this context is that especially middle-income individuals have been identified as potential migrants (Castles and Miller 1998: 20). On the other hand, new economic theories of migration (e.g. Stark and Levhari 1982; Maier 1985; Taylor 1986) underlined the meaning of the factor 'household'. Hence, it was stressed that the migration decision normally is not only made by the individual but by the household he or she belongs to. Another important aspect in this context is the fact,

that in many cases some members of the household stay at their place of origin while others migrate. Several studies (e.g. Konseiga 2005; Halliday 2005) found that migration is an important risk coping strategy for households.

In the current economic research on migration the factor 'household' got complemented with the analysis of other community factors like the village in which the potential migrant(s) and his or her household live. Another aspect the current migration research stresses in particular is the meaning of culture and tradition (two factors, Stark (2003) combines in the word "taste"). Especially the cultural attitude towards migration plays an important role in this context. For instance, Stark (2003) has shown that a society with a cultural disposition to migration will likely bring up more migrants than a society without such a disposition.

Thus, the current economic research on migration considers three levels: the individual, the family and the community level. Due to the structure of the underlying data set of this study we mainly focus on the household level.

Engel and Ibañez (2001) added the factors 'violence' and 'insecurity' as additional elements of risk into the migration debate. Based on a case study in Colombia, they consider the role of violence and perception of insecurity in motivating displacement and discuss important differences between conventional migration theory and migration in a context of violent conflict. They find that, as expected, violence is a significant driving force of displacement, but that economic incentives (including the cost of leaving behind important assets and potential improvements in living conditions after displacement) also significantly affect the displacement decision.

It is obvious that the factor human (in)security also plays an important role for this study; the perception of human security means in general the freedom from want and fear (Brauch 2005: 3). Thus, threats to human security do not only evolve from violence but also from natural disasters like the tsunami. We therefore add the factor "vulnerability" into the migration debate which will be further explained in the following sections 2.2 and 2.3.

2.2 Vulnerability

One of the most important elements in the interdisciplinary research concerning risks and the impacts of natural disasters within the last years is the aspect of vulnerability. According to Benson and Clay (2004), the term "vulnerability" can be defined as the potential to suffer harm or loss, expressed in terms of sensitivity and resilience or of the magnitude of the consequences of the potential events. A natural disaster like a tsunami is a hazard that negatively affects vulnerable individuals, households or communities. While in the past, scientists focused more on the hazard itself, current research has shifted towards the analysis of the livelihood of affected households in order to reduce their vulnerability or susceptibility to such hazards (Bogardi 2004). This paradigm shift is based on the recognition that a natural hazard is not a disaster by

itself, but rather becomes a disaster if vulnerable people are around who have been hit by the hazard with severe consequences. Thus, according to Schneiderbauer and Ehrlich (2004) for example, the term "vulnerability" is used to express the understanding that the extent to which households suffer from disasters is determined by first, the likelihood of being exposed to hazards, and second, their capacity to withstand them which relates to the socio-economic circumstances of the household.

There exist many different concepts and definitions of the term "vulnerability". UNDP for example describes vulnerability as "a human condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage from the impact of a given hazard" showing how multi-dimensional the concept of vulnerability is (UNDP 2004: 11).

Albeit this apparent wide spectrum of concepts, it is indisputable, that vulnerability has at least four dimensions including the following (Mechler 2003: 14):

- *Physical vulnerability*: this relates to the susceptibility to damage of engineering structure and infrastructure such as houses, dams or roads.

- *Social vulnerability*: the ability to cope with impacts of a natural disaster on the individual level.

- *Institutional vulnerability*: this dimension refers to the existence, robustness and the capacities of institutions to deal with and respond to natural disasters.

- *Economic vulnerability*: the last dimension of vulnerability is related to the economic or financial capacity to finance losses and return to a previously planned activity path. This may relate to private individuals as well as companies and the asset base and arrangements, or to governments that often bear a large share of a country's risks and losses.

All these dimensions mentioned are also relevant in our context. In general, we consider the study area of the survey to be a high-risk area, and those people living in the area are more vulnerable than those households who (are going to) migrate. Furthermore, we will show that the (potential) migrants were the ones who were mostly affected by the tsunami and thus, were the most vulnerable. We take note of the fact that vulnerability is a dynamic concept and can change over time depending on investments and behaviors of different stakeholders (households, state etc.).

Many studies (e.g. Benson and Clay 2005) have shown that especially the poor population groups are the ones who are the most vulnerable. The question occurs whether migration is a possible coping strategy in the context of natural disasters for households in order to reduce their vulnerability. In fact, natural disasters often generate migration of people away

from the affected areas (see for example Blaikie et al. 1994; Parker et al. 1997; Smith and Ward 1998). This is simply reasoned by the fact that people often lose their houses and other assets as well as their employment opportunities in the affected areas.

However, migration does not always occur as a result of disasters. Sometimes, people forget soon after the disaster about their fear of future tsunamis which are said to occur only randomly[1], and thus return to their homes in the high-risk areas (Mileti 1999), or they return for lack of reasonable alternatives. Paul (2005) found evidence from a survey of close to 300 households in tornado-affected areas in Bangladesh that disasters did not always create out-migration. The major reason for this was that the households received more disaster relief in monetary terms than the damage they incurred. Paul (2005) further stated that emergency aid seemed to have acted as a pull factor, convincing affected households to remain in the tornado-affected villages.

In general, the reasons driving people to stay or leave the disaster-prone areas are still poorly understood. Given the potential consequences of tsunamis in highly exposed areas which result in enormous number of deaths and massive damages to public infrastructure and private housing and household assets, there is a need to pay more attention to the option of migration as a potential copying strategy to reduce vulnerability of households. Our analysis therefore aims at identifying the characteristics and motivations of the more vulnerable people staying in the tsunami-struck area, compared with those who migrate or intend to migrate to safer places after the tsunami, and who are therefore less vulnerable now. Furthermore, the vulnerability implications of different support schemes and disaster relief will be investigated more in detail since these factors can be possible impeding factors to migration and thus the reduction of vulnerability.

2.3 A Framework for the Analysis of the Migration Decision

Based on the study by Engel and Ibañez 2001, we develop a theoretical framework for the empirical analysis of migration decisions as a response to natural disasters like tsunamis. Similar to violence, also natural disasters introduce non-economic risk elements into the migration literature.

[1] In the last 4000 years, 79% of the tsunamis with dead victims were registered to have occurred in the Pacific Ocean and 14% in the Atlantic Ocean, while only 7% were registered in the Indian Ocean. However, the numbers must be interpreted with some care. Thus, about 70% of these disasters were registered in the last 200 years. In addition, these numbers do not indicate the magnitude of the disasters, as being evidenced by the latest tsunami from 26th of December 2004 in the Indian Ocean with the highest number of victims ever counted (Borman, 2005). A further source indicates that about 1 to 2 damaging tsunamis are likely to occur for the whole area of the Indian Ocean in a period of 10 years (Lühr, 2005).

2.3.1 Conceptual framework

A very general way to present the migration decision is the following (Engel and Ibañez 2001): a household head decides to displace with the entire or part of his family if the expected utility of staying in the place of origin is lower than the expected utility from displacement, or

$$EU_{id} > EU_{in} \quad (1)$$

where

U_{ij} is the indirect utility function of household i at place j, where $j=d$ denotes the place of reception and $j=n$ denotes the place of origin, and

E is the expectations operator.

We can rewrite the expected utility as:

$$EU_{ij} = v_{ij} + \varepsilon_{ij} \quad (2)$$

where v_{ij} is the observable utility and ε_{ij} is a random term with a mean of zero. The random term includes all unknown or not quantifiable variables like stress and traumas.

The observable utility of staying at the place of origin or moving to the place of reception depends on a variety of factors. First of all, the perception of the safety level at the places of origin and that of reception is an important determinant of the utility function. Second, the income and the standard of living at the two locations affect the level of utility. Third, migration and information costs depending on the access to transport or the existence of relatives at the receptor location are important for the estimation of the costs and benefits of migration. Finally, the migration propensity might be affected by socio-demographic characteristics of the household, as these determine the household's preference structure. The latter will determine how the household evaluates the tradeoffs between the increased security from natural disasters like a tsunami and the uncertainty of living conditions after migration.

Thus, we write the observable utility as

$$v_{ij} = f(S_{ij}, Y_{ij}, C_{ij}, Z_{ij}) \quad (3)$$

where

S_{ij} = perception of safety for household i at place j,

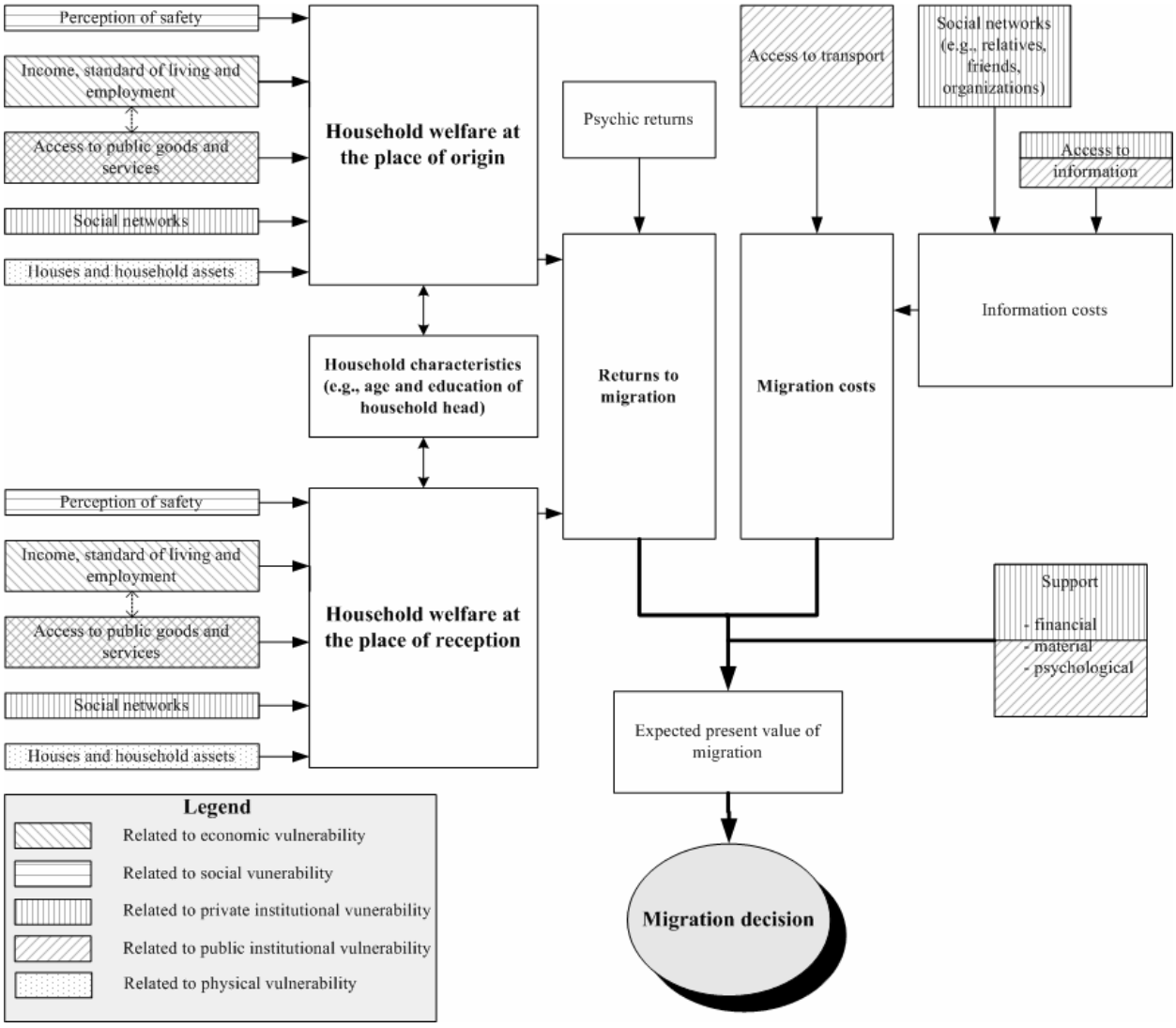
Y_{ij} = income and standard of living for household i at place j,

C_{ij} = migration and information costs,

Z_{ij} = household characteristics which influence preferences.

These observable factors also relate to different aspects of vulnerability. While the perception of safety relates especially to social and physical dimensions of vulnerability, income and the standard of living play a role in determining economic vulnerability. Migration and information costs determine the economic and institutional aspects of vulnerability of a household. Figure 1 shows the detailed process and its interlinkages with the different types of vulnerability which lead with respect to our case to a specific migration decision.

Figure 1: Conceptual Framework of the migration decision in the context of natural disasters



Source: Own presentation based on Byerlee (1974: 553).

2.3.2 Specific proxies and hypotheses

In the following, we describe the variables used for measuring the four observable classes of factors of relevance to the migration decision and the corresponding hypotheses. It has to be mentioned that some variables like education, sex and age of the household head will be used as proxies for more than just one factor. Thus, if the direction of the hypotheses differs, the aggregate impact of these variables may be ambiguous so that the hypotheses cannot be tested in detail.

1) Perception of safety of the household at the place of origin

The general hypothesis related to the perception of safety is that the probability of migration increases with the level of insecurity at the place of the household's origin. The variables which will be used as proxies for measuring the perception of safety are:

- *Bad experiences with the sea:* We expect that bad experiences with the sea before the tsunami (e.g. flooding, seaquakes) increase the household's perceived level of insecurity.
- *People being killed or heavily injured by the tsunami:* Also for this variable we would expect a positive correlation: The more dead, missing or heavily injured members are to be found in a household, the higher will be its level of perceived insecurity and thus, its decidedness to migrate.
- *Damage of the house:* A positive sign on this variable is expected.

2) Income and standard of living

With respect to the income and standard of living, it is necessary to differentiate between the place of origin and the place of reception. Hence, we expect that the probability of migration decreases with the standard of living and income at the place of origin and increases with the expected standard of living and income at the place of reception. The variables being used as proxies for the expected standard of living and the expected income at a (possible) new place, are:

- *Characteristics of the household head (age, education):* We expect that households led by younger heads have a higher affinity to migrate than households with older heads (according to results from many studies on migration). Moreover, it is expected that higher levels of education cause a higher probability of migration than lower levels of education, because a higher level of education is often closely associated with a higher income in a new (urban) area of reception. However, education may also have an impact on information provision which may counteract this effect. For example, Engel and Ibañez (2001) find that improved access to information about living conditions at the place of reception tend to deter migration in the context of violence in Colombia by reducing overly optimistic expectations.

- *Relatives at the place of reception:* The direction of this effect is conceptually ambiguous. On the one hand, we expect that if a household has relatives at the place of reception, this will be an incentive for the household to migrate because relatives at the place of reception could be an enormous help in finding employment or housing. On the other hand, relatives at the place of reception can also create disincentives, in case the relatives themselves are not happy with their new location for example in terms of finding appropriate housing, the possibilities of finding a proper job, or the chance of receiving government support. In that case, a household living in the tsunami-area will be less willing to migrate, since he or she has a more realistic view on what to expect at the place of reception.

The variables of the standard of living and the expected income at the place of origin are estimated by:

- *Ownership of the land and house the household lived in before the tsunami:* We expect that the factor ownership has a negative effect on the probability of migration since households are less likely to be willing to leave their property.
- *Possession of boats after the tsunami:* We expect that the possession of boats after the tsunami will have the same affect as ownership of the land and the house the household lived in before the tsunami as the household will be less likely to move inland to a lower-risk area where the boat will be of no or less use.
- *Possession of motor vehicles after the tsunami:* The expected effect of this variable is ambiguous: although the possession of motor vehicles after the tsunami could alleviate a "new start" at the old place, it also could decrease migration costs.
- *Per capita income of the household before the tsunami:* Also with respect to this variable, we expect an ambiguous effect: On the one hand, a higher per capita income makes a rebuilding in the place of origin much easier than a low per capita income, but on the other hand, it could have a positive impact on migration, because migration costs can be more easily covered by a higher household savings level (which we assume to be correlated with income).

3) Migration and information costs

The migration and information costs which are associated with the decision to move include the following variables:

- *Years lived in the area before the tsunami:* It is expected that the longer a household has lived in an area, the stronger (and so the more emotional) are its links to this area. Thus, the longer a household has lived in the area the lower will be its probability of migration.
- *Education of the household head:* As stated earlier, a higher level of education may lower information costs, but the effect is dependent on the type of information.

- *Relatives at the place of reception:* As already mentioned this variable is also ambiguous and depends on the type of information.
- *Membership in one or more organizations:* The membership in at least one organization may have an impact on the probability of migration, because such a household will most likely be part of an information network. But again in this case, the question, whether this effect will be positive or negative, will depend on the type of information, the household will receive about a possible new place. On the other hand, a household that is member in more organizations may be more established in the place of origin, which we expect to lead to a lower propensity to migrate (higher migration cost).
- *Access to information:* We expect that the access to information (TV, radio, internet, etc.) has an effect on the probability of migration. The hypothesis here is two-sided again, because the type of effect will depend on the kind of information.
- *The receiving of support:* Also for this variable we expect ambiguous effects on the migration decision, because on the one hand, the support could be used for a new start at the place of reception, or for covering the migration costs. On the other hand, disaster relief can also impede out-migration because it helps people to build up again their damaged houses in the high-risk area. Thus, we would expect the effect to depend on the type of support provided. The provision of construction materials is expected to discourage migration, while other (particularly) financial compensation is expected to facilitate migration.
- *Possession of motor vehicles after the tsunami:* If a household possesses a motor vehicle after the tsunami, it is easier for a household member to reach sources of potential disaster relief or information centers. The use of disaster relief depends on the preferences of the household, as discussed above. Also the access to information can have already described ambiguous effects on migration. Moreover, possession of motor vehicles can reduce migration costs directly by facilitating transport.
- *Per capita income of the household before the tsunami:* See above.

4) Household characteristics

- *Age of the household head*: We would expect older households to be more risk averse. The effect on migration will depend on which risk (the risk of becoming victim of another natural disaster or the risk of not finding employment at the place of reception) is valued more strongly by the household. Thus, the effect is *ex ante* ambiguous.
- *Sex of the household head*: We assume that female household heads are more risk averse than male ones. Again, the effect is ambiguous and depends on which risk is considered to be more important.

From the above discussion it is clear that many factors have conceptually ambiguous effects on the migration decision. The actual direction of effect can therefore only be determined through empirical analysis (discussed next).

3 Data and Descriptive Analysis

3.1 The Data

To gain a better understanding of the various vulnerabilities of different social groups affected by the tsunami, a survey of 500 households has been conducted in September 2005 in the district Galle in the Southern Province of Sri Lanka - about 8 months after the tsunami had happened (Map 1).

Map 1: The Study Region

Source: Own presentation

The data is characterized as follows:

- A total of 216 households (43%) state that they are not willing to migrate; some households of this group currently live in temporary homes but have the firm intention to go back to their old places. We refer to them as the non-migrant households.

- 118 households (24%) intend to leave their old homes in the near future (nine of them already having done so), and thus we call them the migrant households.

- 166 households (33%) are still undecided about their decision of migration.

3.2 Descriptive Analysis

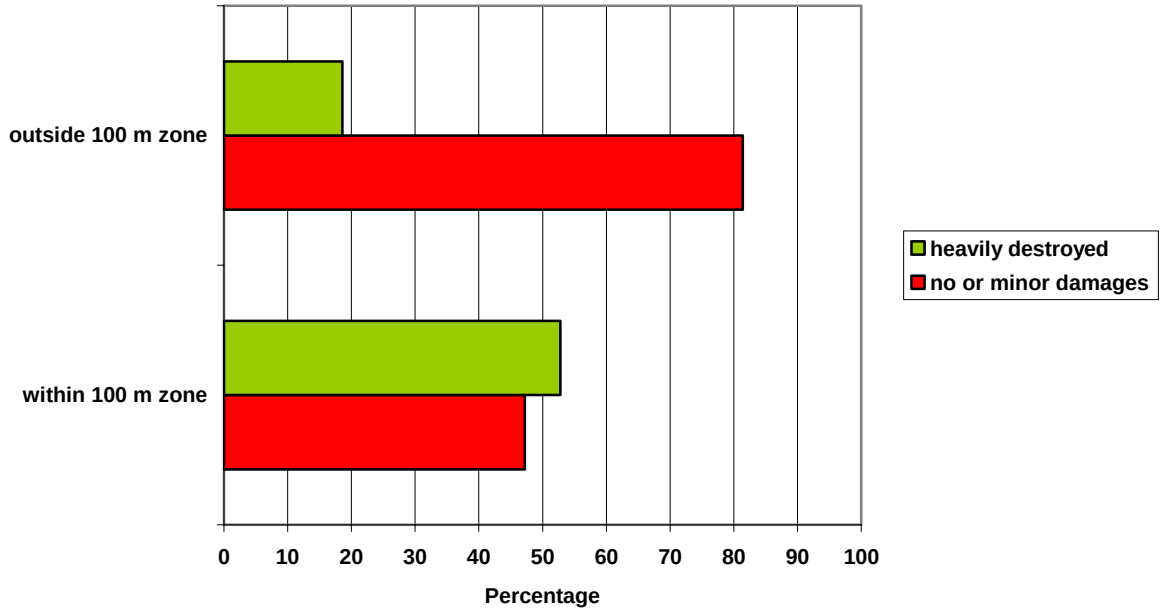
In the following section, the descriptive statistics based on the survey are presented. The descriptive analysis focuses especially on the differences and similarities between migrants and non-migrants. It is structured according to the different dimensions of vulnerability, namely physical (e.g. perception of safety), social (e.g. standard of living), institutional (e.g. support situation), and economic vulnerability (e.g. 100 m zone).

3.2.1 The 100 m Buffer Zone

About 35% or 178 households of the interviewed households lived in houses located within the 100 m buffer zone from the mean sea level. The other close to 65% or 321 households were located further away from the sea. Since especially people living within the 100 m zone were negatively affected by the tsunami, the Government prohibits new construction within this 100 m zone (in some areas 200 m). In fact, half of the 143 houses which were heavily damaged by the tsunami were located within the 100 m zone, while 81% of the houses outside the 100 m zone just had minor or even no damages (see Figure 2). Furthermore, 26 % of the households who lived within the 100 m zone have had at least one killed, missing or seriously injured member in the household in comparison with just 12 % of the households living outside this zone.

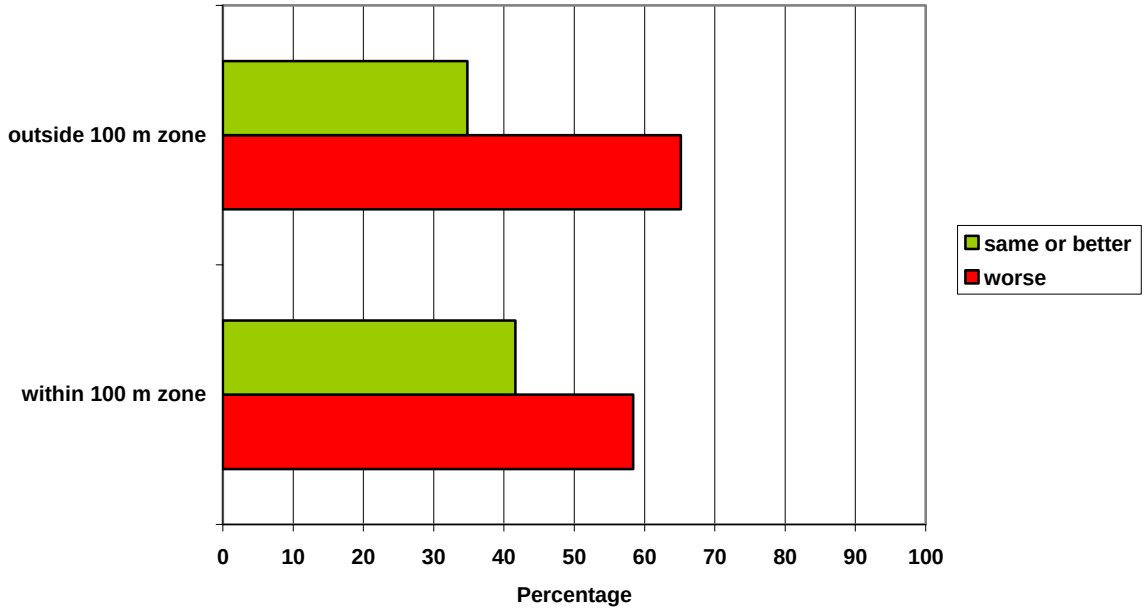
Being asked about their opinion whether the establishment of a 100 m zone is appropriate, close to 80% of the respondents agreed that it is. Interestingly, even the majority of households who named fishing as a main source of income agreed that the establishment of a 100 m zone would be appropriate with about half of these households living within and half outside the 100 m zone.

Figure 2: House damages – within and outside the 100 m zone



Thus, most physically vulnerable (according to house damages and injured, missing and killed humans) households were those who lived in the 100 m zone before the tsunami. We also looked at the change in income before and after the tsunami, in order to measure the economic vulnerability of those households living in the 100 m zone in comparison with the "non-buffer-zone" households.

Figure 3: The change in income due to the tsunami – households within and outside the 100 m zone

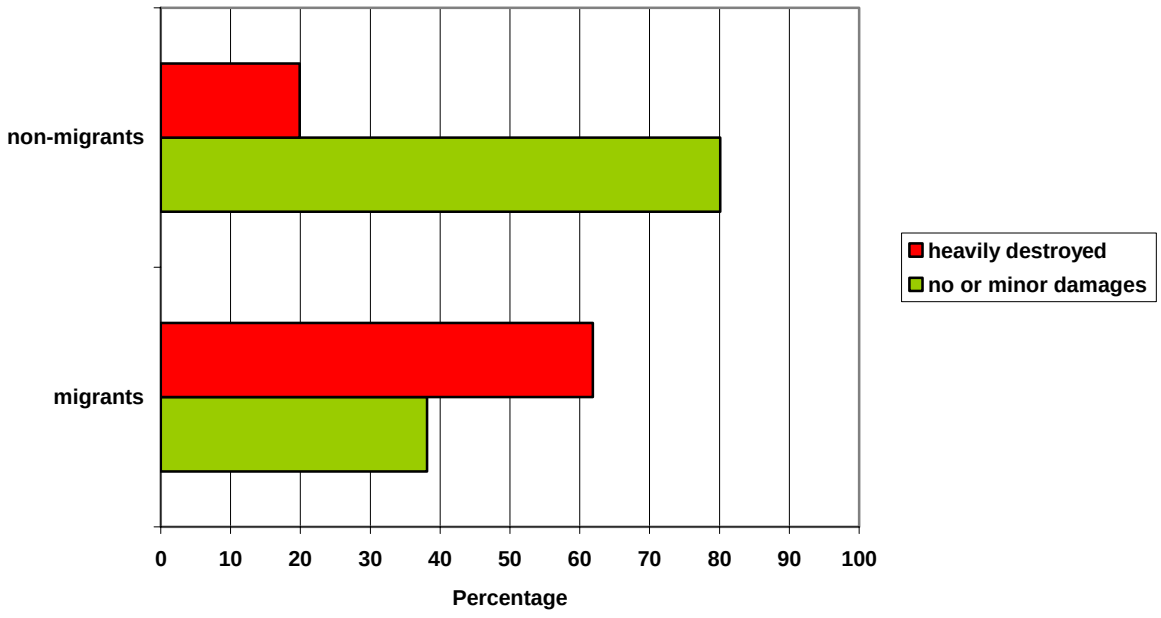


There is evidence that the more vulnerable 100 m zone households are more likely to migrate than non buffer zone households: 60% of the households that have lived within the 100 m zone before the tsunami are now willing to migrate in comparison with just 22% of the non-buffer zone households stating that they are willing to leave their old residence. Thus, in our case it seems that the more vulnerable a household is, the more likely is its migration. Since "living in the buffer zone" is correlated with high personal and material damage (see above), it is not advisable to use a buffer zone variable in the migration decision regression because of the possible danger of multi-collinearity.

3.2.2 Perception of Safety

The survey revealed that the migrant households are much more affected by a total destruction of their houses than non-migrant households (see Figure 4): 62% of the migrants and just 19% of the non-migrants state, that their houses were destroyed so heavily that they are uninhabitable now. The differences between migrants and non-migrants concerning the rate of house destruction can easily be explained by the fact that 60% of the migrants and just 20% of the non-migrating households lived inside the 100 m-zone before the tsunami; this indicates some support for the hypothesis that the higher the physical vulnerability (in terms of house damage), the higher will be the probability of migration for the corresponding household.

Figure 4: House damages – non-migrant and migrant households



An interesting fact is that just 8% of the non-migrating households have had bad experiences with the sea (in forms of floods or seaquakes) before the tsunami compared to nearly 30% in the migration group. This also seems to support the idea that households who were negatively affected by the sea in the past, are more likely to migrate after the tsunami.

With respect to physical injuries, about 83% of the households indicated that they suffered no or only minor injuries, 8% of the respondents reported about serious injuries and hospitalization of family members, while close to 9% of the respondents lost or still miss family members. Interesting is, that just 13 % of the non-migrant households have dead, missing or seriously injured members, whereas 26 % of the migrant households have members, which were affected by the tsunami. This evidence also supports the hypothesis that households with members being affected by the tsunami are more likely to migrate.

Concerning the question, whether a pre-warning system for tsunamis should be installed to increase the overall safety level, the difference between the two groups is less significant: 85% of the non-migrant and 95% of the migrant households would approve the installment of such a system.

3.2.3 Standard of Living and Income, and Changes in Living Conditions

Regarding the income before and after the tsunami event, almost 15% of the households indicated that they have now more income available compared with the situation before, while around 20% of the households have the same amount, and the remaining 65% have less income now available. Interestingly, most of the households with now higher income availability are also those who returned to the tsunami area, and only a few of them decided to move in the near future.

With respect to the status of employment, the figures for both groups are also nearly identical; 78% of the non-migrant and 79% of the migrant heads indicated that they are currently unemployed, not able to work or have no permanent work place. Almost astonishing is the response to the question “Do/ did you have confidence of finding a new job at a (possible) new place?”, 65% of the non-migrant households state that they are confident in finding a new job, if they went to a new location, and 68% of the migrant households are confident in finding a new job at their (possible) place of reception.

A significant difference between the two groups can be found with respect to the question of land ownership: 90% of the non-migrants but only 54% of the migrants owned the land and the house they lived in before the tsunami. This supports the hypothesis that immobile assets function as pull factors in the high-risk areas, meaning that house and land owners are less likely to migrate.

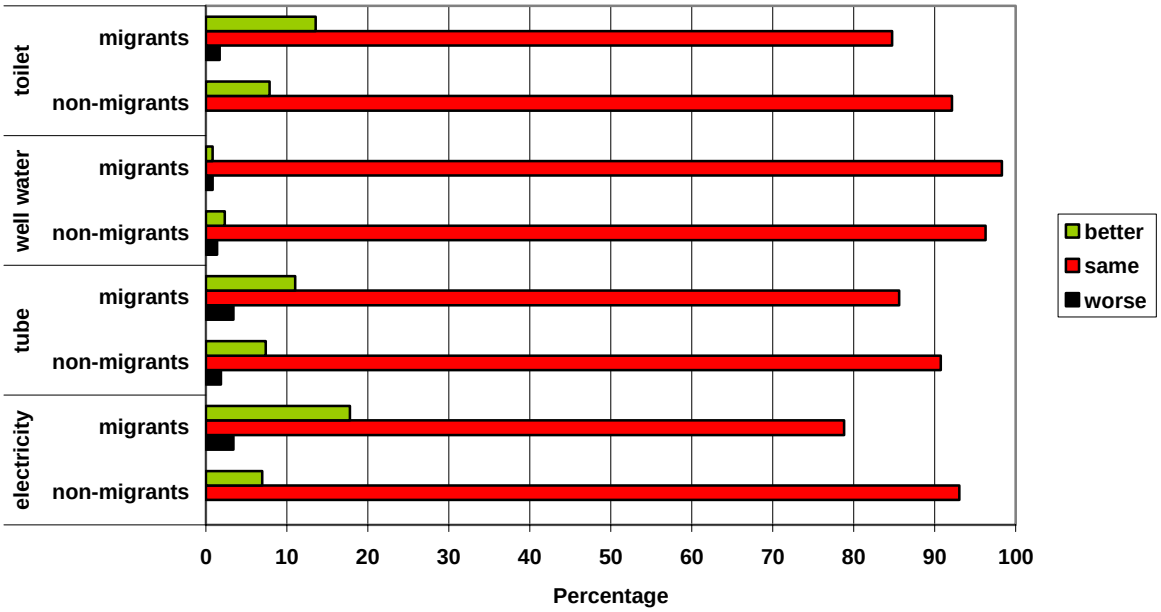
Concerning the question of possession of motor vehicles (cars, motorbikes, etc.) and boats, there are no significant differences between the two groups: only 2% of the non-migrant and 1% of the migrant households own a boat after the tsunami (although in total 8% of all households state that fishing is their main source of income), whereas 11% of the households of each group own a motorized vehicle.

Being asked "how are your current living conditions compared to those before the tsunami?", 79% of the non-migrant and 84% of the migrant households answered with "worse than before". Less than one percent in each group state that their living conditions are now better than before the tsunami.

Figure 5 compares the situation of access to some selected public services for each group before and after the tsunami. As can be seen, most respondents indicate that their access to public services is the same. However, a relatively higher percentage value of migrant households - compared with non-migrant households - indicate that their access is better after than before the tsunami.

Standard of living and income are both related to economic vulnerability. Interestingly one can hardly say that there is a relation between economic vulnerability and migration.

Figure 5: Situation of access to selected public services after the tsunami compared with the situation before the tsunami – non-migrant and migrant households



3.2.4 Migration and Information Costs

Migration implies the loss of a social network at the place of origin. We would expect this impact to be stronger the more years a person had lived in a certain area. The results, however, indicate that the differences between migrants and non-migrants turn out to be very marginal. 72% of the non-migrants and 75% of the migrant households lived in their areas for more than 20 years, and 60% of the non-migrant and 68% of the migrant household heads are members in at least one organization in their place of origin. Thus, the affiliation to and the

social network existing in the place of origin do not seem to affect the decision of a household to migrate or not.

Also regarding the question if the household has relatives living at the (possible) new place, the shares of respondents are identical: 46% of the non-migrant households and 46% of the migrants have relatives at the (possible) new place of reception.

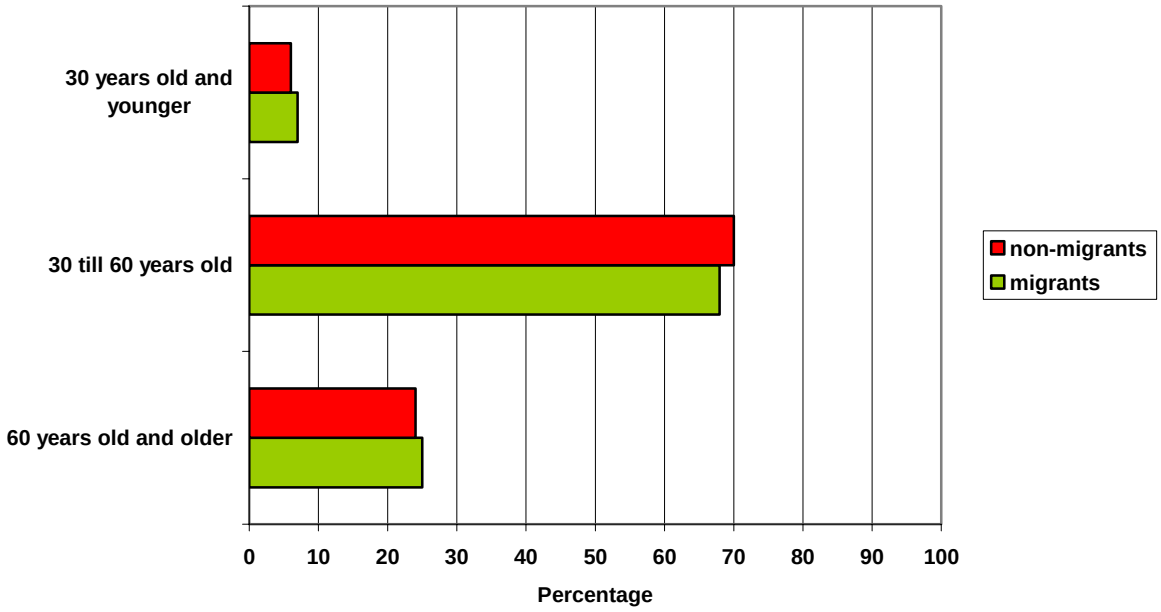
Interesting is the fact, that only 70% of the migrants had access to information (TV, radio, etc.) whereas 84% of the non-migrant group had information access right after the catastrophe has happened. This could indicate that information access has a rather discouraging effect on the migration decision.

As indicated above, a significant difference between the two groups can be found with respect to the question of land ownership: 90% of the non-migrants but only 54% of the migrants owned the land and the house they lived in before the tsunami. This observation supports our earlier hypothesis that ownership in the place of origin lowers the willingness to migrate since it increases the costs of migration.

3.2.5 Household Characteristics

It has been hypothesized that a household with a younger head might be more likely to migrate because of being less risk-averse. However, there seems to be no real difference between the group of migrants and non-migrants concerning the characteristics of the head of household: 6% of the non-migrant household heads and 7% of the migrant heads are 30 years old or younger, 70% of the non-migrant household leaders and 68% of the migrant heads are between 30 and 60 years old, and finally, the share of non-migrant household heads, being older than 60 years is 24%; the corresponding Figure for the migrant group in this age category is just 2 percentage points higher (see Figure 6). Thus, the age of the household head does not seem to play a role in the decision to migrate or not.

Figure 6: Age structure of the heads of households – non-migrant and migrant households



Concerning education and gender, the differences are more or less marginal between the two groups: 30% of the non-migrant and 35% of the migrant household heads had no or a school education of up to six years, whereas the majority of the non-migrant (70%) and of the migrant households (65%) had an advanced school education or even a college education. 26% of the non-migrant and 22% of the migrant households are female-headed.

With respect to the ethnic composition, the survey has shown that the share of Sinhalese households within the group of migrants is nearly 10 percentage points higher (77%) than within the non-migrant group (68%). The remaining 23% and 32% respectively are Muslim households (plus one Tamil household within the group of the non-migrants). The share of Sinhalese households within the total sample is 71%.

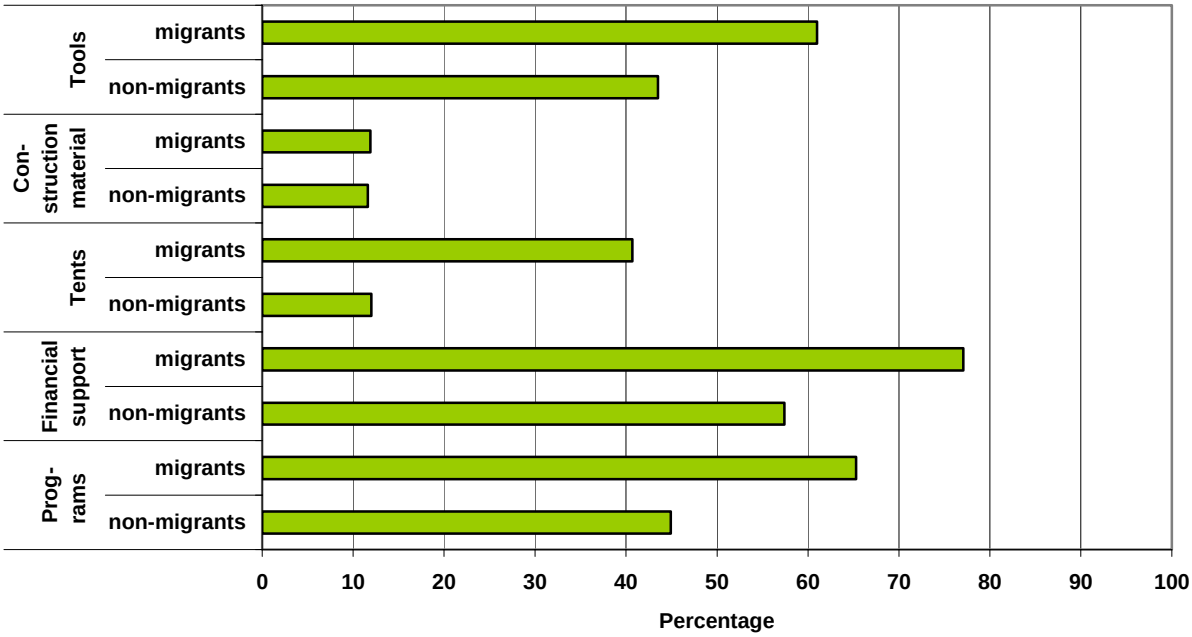
3.2.6 The Support Situation

Many different support activities were initiated to help the people in the tsunami-affected areas. Concerning the provision of food there are no differences between migrants and non-migrants; 94% of each group stated, that they received food from an organization or a public institution after the tsunami. Also regarding the participation in "work for food" programs the differences are very low: 43% of the migrant and 40% of the non-migrant households have participated in such programs. But there are differences concerning

- financial support (which contains direct financial aid as well as subsidized and non-subsidized loans and credits),
- material support (which contains the receipt of construction material, tools and/ or other equipment and tents), and

- the participation in special psychological programs (which contains programs for women, children/youth and elderly people or other psychological support schemes).

Figure 7: Percentage share of households within the non-migrant and migrant group that received financial, material and program support



As Figure 7 shows, migrant households received clearly more material, financial and psychological support than non-migrant households. The only exception is the receipt of construction material. This indicates that the more support a household has received in any of the forms described above (with the exception of construction material), the more likely is a positive migration decision of the household.

Not very surprising is the fact that the support situation for the households who have lived in the 100 m zone before the tsunami is absolutely comparable to the one of the migrant households: 73 % of the buffer zone households received financial support (62 % of the other households), 71 % of those households received material support (48 % of the non-buffer zone households) and 61 % of the buffer zone households have participated in at least one program (46 % of the other households).

Regarding the provision with other forms of support, which comprehend a wide spectrum from health service to technical assistance or transport services, a difference is de facto non-existent, because 94 % of the non-migrant and 95 % of the migrant households received support of such kind.

4 Regression Analysis

The survey data presented in Chapter 3 were used to empirically assess the factors which determine the probability of a household to migrate after the tsunami or not. The definition of the variables used in the regression analysis is presented in Table 1. A descriptive analysis of the variables is provided in Appendix, Table A1.

Table1: List of variables used in the econometric analysis

sea_exp	=1 if the household has had bad experiences with the sea before the tsunami, =0 otherwise
ownership	=1 if the household owns the land and the house they lived in before the tsunami, =0 otherwise
house_damage	=1 if the house is heavily destroyed, =0 otherwise
hhh_age	Age of the head of household in years
info_access	=1 if the household had any kind of information access (TV, radio, internet, etc.) right after the tsunami, =0 otherwise
male_hhh	=1 if the head of household is male, =0 otherwise
education	=1 if the head of household has a higher education, =0 otherwise
membership	=1 if household is member in at least one organization, =0 otherwise
years_in_area	Years the household has lived in the area before the tsunami
relatives	=1 if the household has relatives or friends in the new area or a possible new area, =0 otherwise
affected	=1 if the household has one or more members which were killed, seriously injured or are still missing, =0 otherwise
affe_owner	=1 if affected = 1 and ownership =1, =0 otherwise
boats	=1 if the household still owns one or more boats, =0 otherwise
motorveh	=1 if the household still owns one or more motorized vehicles, =0 otherwise
root_pci	Square root of per capita income of the household; =0 otherwise
sinhalese	=1 if the household is Sinhalese; =0 otherwise
ftt_support	=1 if the household has received financial and/ or material support in form of tents and/ or tools, =0 otherwise
construct	=1 if the household has received construction material, =0 otherwise (485 cases)
fin_support	=1 if the household has received financial support, =0 otherwise (485 cases)
tenttool	=1 if the household has received tents and/ or tools, =0 otherwise (485 cases)
program	=1 if the household could participate in a program, =0 otherwise (485 cases)
buff_zone	=1 if the household has lived in the 100 m zone before the tsunami, =0 otherwise
migra_wo_irr	=1 if the household has the intention to migrate or already migrated, = 0 if the household is going to stay at its old place. Households which are still irresolute in their migration decision, are missing (324 cases remaining).
bz_migra	=1 if the household has lived in the 100 m zone and wants to migrate now, =0 if the household has lived in the 100 m zone and wants to stay. Households which have lived in the 100 m zone and are now still irresolute concerning their migration decision, are missing (118 cases)
migra_w_irr	=1 if the household is irresolute in its migration decision, = 2 if the household has the intention to migrate or already migrated; = 0 if the household is going to stay at its old place (442 cases)

4.1 Determinants of the Migration Decision

The regression results from the econometric analysis are presented in Table 2. The dependent variable is a dummy variable reflecting the decision of the household to migrate after the tsunami to reduce its vulnerability or not. In general, the results are reasonably robust to changes in the set of independent variables included in the regression. Additionally, Table 2 presents the same regression including the additional variables "ftt_support" and "construct".[2] This is done to shed some light on the effect of aid programs on the migration decisions. While the results on other variables are quite robust to this change, some caveat is in order, as the support variable may be endogenous, i.e., whether a household receives support may depend on some of the same variables affecting the migration decisions. This issue is further discussed below. The estimated relationship for the probability of migrating correctly predicts 83 % of the observations (see Appendix, Table A3).

Table 2: Logit regression results on the migration decision (with and without variables ftt_support and construct)

	with variables ftt_support and construct			without variables ftt_support and construct		
Variables	**Coef (Std. Err.)**	**P>|z|**	**Marginal Effect**	**Coef. (Std. Err)**	**P>|z|**	**Marginal Effect**
sea_exp	1.57 (0.42)	0.00**	0.36	1.67 (0.42)	0.00**	0.39
ownership	-2.87 (0.50)	0.00**	-0.61	-2.58 (0.46)	0.00**	-0.57
house_damage	1.49 (0.35)	0.00**	0.32	1.75 (0.34)	0.00**	0.39
hhh_age	0.01 (0.01)	0.37	0.00	0.01 (0.01)	0.40	0.00
info_access	-0.77 (0.39)	0.05**	-0.17	-0.75 (0.39)	0.05**	-0.17
male_hhh	0.51 (0.39)	0.19	0.10	0.55 (0.38)	0.15	0.11
education	-0.74 (0.34)	0.03**	-0.14	-0.67 (0.34)	0.04**	-0.14
membership	0.03 (0.16)	0.87	0.01	0.11 (0.15)	0.48	0.02
years_in_area	0.01 (0.01)	0.25	0.00	0.01 (0.01)	0.16	0.00
relatives	0.82 (0.32)	0.01**	0.17	0.77 (0.32)	0.01**	0.17
affected	-1.74 (0.73)	0.02**	-0.27	-1.35 (0.72)	0.06*	-0.23
affe_owner	2.32 (0.87)	0.01**	0.52	1.92 (0.85)	0.03**	0.45
boats	0.02 (1.21)	0.99	0.00	0.30 (1.21)	0.81	0.07
motorveh	0.17 (0.49)	0.73	0.04	0.31 (0.47)	0.51	0.07
root_pci	0.00 (0.01)	0.60	0.00	0.00 (0.01)	0.43	0.00
sinhalese	1.34 (0.40)	0.00**	0.24	1.38 (0.40)	0.00**	0.25
ftt_support	1.45 (0.53)	0.01**	0.24			
construct	-0.51 (0.51)	0.32	-0.10			
_cons	-2.12 (0.95)	0.03		-1.43 (0.87)	0.10	

Dependent variable: migra-wo-irr; n=324 cases
** Significant at the 5% level; * significant at the 10% level
Note: The marginal effects for this and the following logistic regressions were estimated at the means.
Source: Own calculations

[2] The variable "construct" was used separately in the logistic regression, because we expect, that the receipt of construction material will not have a positive impact on the migration decision contrary to the receipt of financial compensation or other material compensation (see page 23).

The results in Table 2 reveal that the decision of a household to migrate or not after a natural disaster like a tsunami is significantly influenced by safety considerations of the household. The hypotheses that bad experiences with the sea which happened before the tsunami, and that the damage of the house due to the tsunami, both have a positive effect on the migration decision, are clearly supported by the results. Those two experiences seem to create a feeling of insecurity, so that people become more prone to migrate to a different place.

As expected, the sign of the variable 'ownership' is negative and significant, indicating that households owning land and a house in the place of origin are less likely to move to a new place. This is intuitive, as migration implies a loss of these important assets for the household. However, the interaction term of the two variables 'affected' and 'ownership' has a positive coefficient and is significant, indicating that land ownership did not affect as strongly the migration decision of households who had one or more members killed or seriously injured. This indicates that economic considerations may play a less important role for those households faced with high perceived insecurity.

Interestingly, the variable "affected" has a negative coefficient; thus, the hypothesis, that households who had one or more members dead, missing or seriously injured as a consequence of the tsunami, were less likely to migrate. The initial expectation was that the more affected households are also more likely to escape from the place where they made these bad experiences. However, the opposite effect found appears to indicate that households might be so traumatized that they just stay where they are, not being able to start a new existence at a new place.

The decision to migrate to a new place also significantly depends on whether the household has any relatives and family ties to the place of reception. Households with relatives in the place of reception are more likely to move, indicating that these households can reduce information and migration costs through the existing network at the receptor place. The positive effect of the number of years lived in the place of origin on the likelihood of migration is puzzling, as it was expected that households who are more emotionally attached to the area would be less likely to migrate. The effect is, however, only significant at the 13% level. The social network at the place of origin, measured in terms of membership in local organizations does not have a significant impact on the migration decision. This is not surprising given the ambiguous conceptual direction of the effect discussed earlier.

The possession of assets like boats or motor vehicles does not seem to have a significant impact on the migration decision either. The hypothesis that households with higher per capita incomes are more able to afford migration and thus are more likely to opt for migration is not supported by the data.

The data analysis shows that Sinhalese households have a higher disposition to migrate than Muslim households. This result supports the argument of Stark (2003) that cultural attitudes towards migration play a role in the migration decision.

Contrary to his or her education, the age of the head of household is not found to have a significant impact on the migration decision. Again, this is not surprising given the counteracting conceptual effects discussed earlier. The education of the household head does influence the migration decision and the effect is significant at the 10% level. The result indicates that less educated households are more likely to move. This might be based on the fact that more educated households are better informed about the situation in the place of reception and are therefore more hesitant to migrate. The results indicate that this information effect appears to dominate the 'potential income effect', i.e., the idea that educated households might expect their employment opportunities to be better at the place of reception. The results also indicate that male-headed households are more likely to migrate than female-headed ones. If we are correct in assuming that male household heads are less risk-averse than female heads, this seems to imply that the risk of finding unfavorable living conditions at the place of reception is valued more strongly than the risk of becoming a victim of another natural disaster.

Those households having access to information from the TV, radio, newspaper or even internet just after the tsunami had happened are less likely to move to another place. They might have received information about the difficult situation in alternative places of reception, or about the support to be received in the near future at the place of origin.

As the data showed a relatively high proportion of households who were undecided regarding migration, which were left out in the logit analysis, we also ran a multinomial logit regression (Appendix Table A2) taking this third group of the undecided households into account. While the first part of the results in Table A2 shows to what extent there is a distinction between the non-migrants to the undecided households, the second part focuses on the non-migrants compared with the migrant households. Overall, the results support the findings of the regression analysis between the two groups, migrant and non-migrant households, as presented in Table 2.

Finally, we find that households who have received financial and/or material support in form of tents and/ or tools after the tsunami are more likely to migrate. The variable 'ftt_supp' turns out to be highly significant. As explained above, this result needs to be taken with some degree of caveat, as the receiving of support may be endogenous. However, when adding the variable to the regression equation, the results hardly change so that we conclude that the equation is reasonably robust to this change.

We also re-estimated the model by considering only the households living within the 100 m zone before the tsunami happened, since this group of households might be considered as being more vulnerable than the households living outside the 100 m zone (Appendix, Table A4). Looking at the descriptive statistics of these 166 households, we find that 71 are migrants, 47 are classified as non-migrants since they returned to their homes, and 48 are still undecided whether to migrate or not. Interestingly, the direction of the results of the regression on the migration decision are comparable with those presented above (Tables 2 and 3), however, the significance level is lower, which mainly is the result of the smaller sample size and the distribution of the variables between the migrant and non-migrant households.

4.2 Determinants of Receiving Support

We used the same data set and methodology to assess the determinants of a household to receive different types of support after the tsunami. The definition of the variables used in the regression analysis is as presented in Table 1.

For financial support, Table 3 shows that whether the household suffered damages to its house naturally plays an important role. Households that had bad experiences with the sea before the tsunami were also significantly more likely to receive financial support. This could be explained by the fact that the concerned households are more familiar with the relevant organizations and the procedures to receive financial support. The significant negative effect of having relatives in other places may be due to such households having support from others and therefore applying less to financial support programs.

Table 3: Factors influencing the probability of receiving financial support and the probability of participation in programs

	Receipt of financial support (fin_support)			**Participation in programs** (programs)		
Variables	**Coef. (Std. Err.)**	**P>|z|**	**Marginal Effect**	**Coef. (Std. Err)**	**P>|z|**	**Marginal Effect**
sea_exp	0.52 (0.29)	0.07*	0.11	0.02 (0.26)	0.94	0.01
ownership	0.21 (0.31)	0.50	0.05	0.09 (0.30)	0.76	0.02
house_damage	0.70 (0.27)	0.01**	0.14	0.55 (0.24)	0.02**	0.13
hhh_age	0.00 (0.01)	0.55	0.00	-0.02 (0.01)	0.05**	0.00
info_access	-0.55 (0.30)	0.06*	-0.11	0.52 (0.27)	0.06*	0.13
male_hhh	-0.06 (0.25)	0.80	-0.01	0.04 (0.23)	0.87	0.01
education	0.25 (0.22)	0.25	0.05	-0.07 (0.21)	0.73	-0.02
membership	0.16 (0.11)	0.14	0.03	0.32 (0.10)	0.00**	0.08
years_in_area	0.01 (0.01)	0.16	0.00	0.00 (0.01)	0.62	0.00
relatives	-0.39 (0.21)	0.06*	-0.09	0.52 (0.20)	0.01**	0.13
affected	0.35 (0.57)	0.54	0.07	1.27 (0.59)	0.03**	0.29
affe_owner	0.33 (0.67)	0.63	0.07	-0.64 (0.66)	0.34	-0.16
boats	0.41 (0.86)	0.64	0.08	0.37 (0.81)	0.65	0.09
motorveh	0.58 (0.34)	0.09*	0.12	-0.46 (0.31)	0.14	-0.12
root_pci	0.00 (0.00)	0.22	0.00	0.00 (0.00)	0.42	0.00
sinhalese	0.31 (0.24)	0.20	0.07	0.38 (0.23)	0.10*	0.09
_cons	0.45 (0.61)	0.46		-0.58 (0.58)	0.32	

n=485 cases
** Significant at the 5% level; * significant at the 10% level
Source: Own calculations

Interestingly, access to information lowers the probability to receive financial support. This may be due to the better knowledge of certain conditions that are combined with the financial aid.

The possession of a motorized vehicle has a positive impact on the probability of receiving financial support. This is not surprising as ‘motorized’ households can more easily reach supporting institutions than other households.

The variables "house_damage", "affected" and "membership" have a positive impact on a household's probability to participate in a psychological program (Table 3). Those programs seem to have a higher grade of acceptance by younger household heads, as the variable "hhh_age" has a negative coefficient. Information access just as the variable relatives at a (possible) new place seems to increase the household's probability to participate in a program.

Table 4: Factors influencing the probability of receiving tents and/ or tools and construction material

	Receipt of tents and/or tools (tenttool)			**Receipt of construction material** (construct)		
Variables	**Coef (Std. Err.)**	**P>|z|**	**Marginal Effect**	**Coef. (Std. Err)**	**P>|z|**	**Marginal Effect**
sea_exp	-1.02 (0.29	0.00**	-0.25	-0.57 (0.52)	0.27	0.02
ownership	0.27 (0.32)	0.41	0.07	0.26 (0.48)	0.59	0.09
house_damage	1.63 (0.28)	0.00**	0.36	1.01 (0.35)	0.00**	0.00
hhh_age	0.00 (0.01)	0.64	0.00	0.02 (0.01)	0.22	-0.03
info_access	-0.05 (0.29)	0.85	-0.01	-0.33 (0.38)	0.38	0.03
male_hhh	-0.18 (0.25)	0.47	-0.04	0.54 (0.42)	0.20	-0.04
education	-0.12 (0.22)	0.57	-0.03	-0.64 (0.38)	0.09*	0.00
membership	0.29 (0.11)	0.01**	0.07	0.01 (0.17)	0.96	0.00
years_in_area	0.01 (0.01)	0.17	0.00	-0.02 (0.01)	0.09*	0.02
relatives	0.26 (0.22)	0.23	0.06	0.22 (0.33)	0.51	-0.03
affected	1.75 (0.71)	0.01**	0.36	-0.46 (0.88)	0.60	0.12
affe_owner	-0.56 (0.80)	0.49	-0.14	1.12 (0.97)	0.25	0.09
boats	-0.14 (0.79)	0.86	-0.03	0.89 (1.15)	0.44	-0.02
motorveh	-0.67 (0.33)	0.04**	-0.17	-0.38 (0.58)	0.51	0.00
root_pci	-0.01 (0.00)	0.03**	0.00	-0.01 (0.01)	0.34	-0.02
sinhalese	0.99 (0.26)	0.00**	0.24	-0.23 (0.35)	0.51	0.02
_cons	-1.35 (0.62)	0.03		-2.59 (0.94)	0.01	0.02

n=485 cases
** Significant at the 5% level; * significant at the 10% level
Source: Own calculations

Table 4 presents the results for the probability of receiving material support in form of tools and/ or tents. Again, the factor "damaged house" has a significant positive impact. Also the membership in at least one organization has a positive impact on the probability of receiving material support. Thus, the households' participation in social networks appears to have a stronger effect than the receiving of financial support. Moreover, there is evidence for households with higher income and access to motorized vehicles being less likely to receive material help. This may be due to material support being delivered directly to the households, and that richer households have more coping strategies on their own.

Table 4 also shows the results for the probability of receiving construction material. As expected, a damaged house increases the chances of a household to receive construction material.

Sinhalese households have been more likely to participate in programs and to receive material support in form of tents and tools than Muslim households. Thus, it can be concluded that the pull effect deriving especially from the receipt of construction material on the migration

decision is less significant for Sinhalese households, explaining why they are more likely to migrate.

In nearly three cases, the 100 m zone variable has a significant or a close to significant positive effect on the probability of receiving appropriate support (see Tables A5 and A6 in the Appendix).

5 Policy Implications

A better understanding of the determinants and effects of the migration decision at the household level helps to define appropriate prevention, assistance and resettlement policies for people living in areas prone to natural disasters. The analysis presented here helps to improve such an understanding by developing a theoretical framework for the empirical analysis of the migration decision of households who have been hit by a tsunami.

We consider the area of the survey to be generally a high-risk area, and those people living in the area are more vulnerable than those who migrate. By understanding the characteristics and motivations of the more vulnerable people who stay in the tsunami-struck area, compared with those who migrate or intend to migrate to safer places after the tsunami and who are therefore less vulnerable now, we can derive a picture about the needs of the people and possible policy support necessary to reduce the vulnerability of households.

Our empirical results show that households with one or more members dead, missing or seriously injured are less likely to migrate. This seems to indicate that affected people are traumatized. Psychological support programs are needed to help the affected people to overcome the trauma experienced by the tsunami.

The results indicate that people with higher education are less likely to migrate, implying that more educated people are better informed and think more realistically about the difficult situation at the place of reception in terms of finding new employment or appropriate housing and support. Thus, employment programs in the place of reception can help to improve the living conditions at the place of reception and thereby encourage migration. The access to information obviously causes a similar negative effect on the migration decision, because it also may provide the appropriate households with a more realistic view on what they can expect at a possible new place regarding job opportunities, living conditions etc, again pointing to the importance of providing more favorable conditions at potential places of reception.

Households that opt to stay in the high-risk areas are often land and house owners in their respective places of origin. They are not prepared to give up their property unless some support will be offered to them. In this case, alternative land and housing offers by the state would be needed to convince the non-migrant households to migrate to safer places.

Relatives in the places of reception help to motivate the affected people to migrate. They have the effects of pull factors since they are the sources of information and of social life for the migrating households. It is impossible to substitute for the family ties of a household by the state but the establishment of social networks, associations or meeting points can up to some extent replace the functions of family ties in the places of reception.

Finally, we find that receiving support (financial and/or material (excl. construction material)) increases the likelihood that a household decides to migrate to a safer location. This implies that current support schemes encourage people to leave the high-risk area. Hence, in this case, support seems to be an adequate incentive instrument to promote migration. However, this result needs to be taken with some degree of caveat, as support may be endogenous and depend on some of the same variables that affect migration.

As the analysis has further shown, all forms of vulnerability seem to play an important role for the migration decision. The most physically and socially vulnerable households, namely those who lived within the 100 m zone, have a strong disposition to migrate. Institutional vulnerability can be reduced by offering support schemes to affected households to encourage them to leave their old place.

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Appendix

Table A1: Descriptive analysis of the variables used in the regression analysis

Variable	Number of Observations	Mean	Standard Deviation	Minimum	Maximum
sea_aff	500	0.18	0.38	0.00	1.00
ownership	500	0.81	0.39	0.00	1.00
house_damage	500	0.29	0.45	0.00	1.00
hhh_age	500	51.57	13.63	5.00	90.00
info_access	498	0.82	0.39	0.00	1.00
male_hhh	500	0.76	0.43	0.00	1.00
education	497	0.40	0.49	0.00	1.00
membership	500	0.91	1.02	0.00	5.00
years_liv	490	37.99	19.56	0.83	85.00
relats	500	0.37	0.48	0.00	1.00
affected	500	0.17	0.38	0.00	1.00
affe_owner	500	0.12	0.32	0.00	1.00
boats	500	0.01	0.12	0.00	1.00
motorveh	500	0.12	0.32	0.00	1.00
root_pc_in~e	500	47.59	27.80	0.00	191.49
sinhalese	500	0.73	0.44	0.00	1.00
ftt_support	500	0.78	0.42	0.00	1.00
fin_supp	500	0.66	0.47	0.00	1.00
tenttool	500	0.54	0.50	0.00	1.00
construct	500	0.10	0.30	0.00	1.00
programs	500	0.51	0.50	0.00	1.00
buff_zone	500	0.36	0.48	0.00	1.00
migra_wo_irr	334	0.35	0.48	0.00	1.00
bz_migra	118	0.60	0.49	0.00	1.00
migra_w_irr	442	0.78	0.84	0.00	2.00

Table A2: Multinomial regression results on the migration decision (with variables ftt_support and construct)

	migra_w_irr with variables ftt_support and construct			**migra_w_irr** without variables ftt_support and construct		
Variables	**Coef. (Std. Err.)**	**P>|z|**	**Marginal Effect**	**Coef. (Std. Err)**	**P>|z|**	**Marginal Effect**
1						
sea_exp	1.56 (0.36)	0.00**	0.17	1.52 (0.35)	0.00**	0.16
ownership	-0.71 (0.49)	0.15	0.09	-0.50 (0.47)	0.29	0.10
house_damage	-0.22 (0.36)	0.55	-0.13	-0.08 (0.36)	0.83	-0.12
hhh_age	-0.01 (0.01)	0.45	0.00	-0.01 (0.01)	0.47	0.00
info_access	0.30 (0.42)	0.47	0.09	0.30 (0.41)	0.47	0.09
male_hhh	0.34 (0.32)	0.28	0.04	0.32 (0.32)	0.32	0.03
education	-0.02 (0.27)	0.94	0.03	0.04 (0.27)	0.89	0.04
membership	0.01 (0.13)	0.96	0.00	0.07 (0.13)	0.60	0.01
years_in_area	0.00 (0.01)	0.60	0.00	0.00 (0.01)	0.61	0.00
relatives	0.71 (0.27)	0.01**	0.09	0.64 (0.26)	0.02**	0.08
affected	-1.09 (0.97)	0.26	-0.13	-0.72 (0.96)	0.45	-0.09
affe_owner	1.40 (1.05)	0.18	0.10	1.10 (1.04)	0.29	0.08
boats	-1.24 (1.23)	0.31	-0.17	-1.04 (1.22)	0.39	-0.15
motorveh	0.37 (0.39)	0.34	0.05	0.42 (0.39)	0.28	0.05
root_pci	0.00 (0.00)	0.98	0.00	0.00 (0.00)	0.89	0.00
sinhalese	0.61 (0.32)	0.06*	0.06	0.67 (0.32)	0.04**	0.07
ftt_support	0.87 (0.34)	0.01**	0.10			
construct	-0.34 (0.46)	0.45	-0.04			
_cons	-1.97 (0.85)	0.02		-1.61 (0.82)	0.05	
2						
sea_exp	1.79 (0.40)	0.00**		1.76 (0.39)	0.00**	
ownership	-2.56 (0.45)	0.00**		-2.35 (0.42)	0.00**	
house_damage	1.46 (0.34)	0.00**		1.66 (0.33)	0.00**	
hhh_age	0.01 (0.01)	0.30		0.01 (0.01)	0.32	
info_access	-0.64 (0.38)	0.09*		-0.61 (0.37)	0.10*	
male_hhh	0.56 (0.37)	0.12		0.56 (0.36)	0.12	
education	-0.65 (0.32)	0.04**		-0.60 (0.32)	0.06*	
membership	0.02 (0.14)	0.91		0.10 (0.14)	0.49	
years_in_area	0.01 (0.01)	0.33		0.01 (0.01)	0.23	
relatives	0.80 (0.30)	0.01**		0.73 (0.30)	0.01**	
affected	-1.43 (0.70)	0.04**		-1.05 (0.69)	0.13	
affe_owner	1.97 (0.83)	0.02**		1.63 (0.82)	0.05**	
boats	-0.31 (1.22)	0.80		-0.02 (1.21)	0.98	
motorveh	0.35 (0.45)	0.43		0.47 (0.44)	0.29	
root_pci	0.00 (0.01)	0.49		0.00 (0.01)	0.36	
sinhalese	1.11 (0.38)	0.00**		1.21 (0.37)	0.00**	
ftt_support	1.43 (0.49)	0.00**				
construct	-0.60 (0.49)	0.23				
_cons	-2.30 (0.91)	0.01		-1.57 (0.84)	0.06	

n=428 cases
** Significant at the 5% level; * significant at the 10% level
Note: here, the Marginal Effects were generated with the STATA command "mfx compute, predict, (outcome(1))".
Source: Own calculations

Table A3: Classification table for the logit regression displacement decision (with and without variables support and construct)

	with variables ftt_support and construct	**without variables ftt_support and construct**
Sensitivity [Pr(+ D)]	67.54%	67.54%
Specificity [Pr(-~D)]	91.43%	91.90%
Positive predictive value [Pr(D +)]	81.05%	81.91%
Negative predictive value [Pr(~D -)]	83.84%	83.91%
False + rate for true ~D [Pr(+~D)]	8.57%	8.10%
False - rate for true D [Pr(- D)]	32.46%	32.46%
False + rate for classified + [Pr(~D +)]	18.95%	18.09%
False - rate for classified – [Pr(D -)]	16.16%	16.09%
Correctly classified	**83.02%**	**83.33%**

Table A4: Logistic regression results for households in the 100 m zone (with and without variables ftt_support and construct)

	bz_migra with variables ftt_support and construct			**bz_migra** without variables ftt_support and construct		
Variables	**Coef (Std. Err.)**	**P>|z|**	**Marginal Effect**	**Coef. (Std. Err)**	**P>|z|**	**Marginal Effect**
sea_exp	0.32 (0.67)	0.63	0.07	0.43 (0.67)	0.52	0.09
ownership	-3.19 (1.11)	0.00**	-0.54	-2.74 (0.99)	0.01**	-0.48
house_damage	1.85 (0.62)	0.00**	0.41	2.03 (0.61)	0.00**	0.44
hhh_age	-0.01 (0.03)	0.68	0.00	-0.01 (0.03)	0.62	0.00
info_access	-0.66 (0.65)	0.31	-0.14	-0.68 (0.64)	0.28	-0.14
male_hhh	1.17 (0.66)	0.08*	0.27	1.22 (0.64)	0.06*	0.28
education	-0.81 (0.58)	0.16	-0.19	-0.86 (0.56)	0.13	-0.20
membership	0.05 (0.31)	0.87	0.01	0.08 (0.30)	0.79	0.02
years_in_area	0.03 (0.02)	0.11	0.01	0.03 (0.02)	0.10*	0.01
relatives	0.66 (0.63)	0.30	0.14	0.68 (0.61)	0.26	0.15
affected	-2.79 (1.20)	0.02**	-0.60	-2.41 (1.16)	0.04**	-0.54
affe_owner	3.68 (1.48)	0.01**	0.45	3.37 (1.43)	0.02**	0.43
motorveh	-0.52 (0.86)	0.55	-0.12	-0.49 (0.84)	0.56	-0.12
root_pci	-0.01 (0.01)	0.10*	0.00	-0.01 (0.01)	0.12	0.00
sinhalese	2.57 (0.80)	0.00**	0.57	2.51 (0.77)	0.00**	0.56
ftt_suppotz	1.41 (0.95)	0.14	0.34			
construct	-0.09 (0.92)	0.92	-0.02			
_cons	-1.54 (1.72)	0.37		-0.77 (1.59)	0.63	

n=113 cases; the 48 undecided households were excluded from this regression.
** Significant at the 5% level; * significant at the 10% level
Note: the variable “boats” = 0 predicts success perfectly; so “boats” was dropped by STATA.
Source: Own calculations

Table A5: Factors influencing the probability of receiving financial support and the probability of participating in programs (with variable buff_zone)

	fin_support			programs		
Variables	**Coef (Std. Err.)**	**P>|z|**	**Marginal Effect**	**Coef. (Std. Err)**	**P>|z|**	**Marginal Effect**
sea_exp	0.49 (0.29)	0.09*	0.10	-0.02 (0.26)	0.93	-0.01
ownership	0.23 (0.31)	0.46	0.05	0.12 (0.30)	0.68	0.03
house_damage	0.61 (0.27)	0.03**	0.13	0.43 (0.25)	0.08*	0.11
hhh_age	0.00 (0.01)	0.56	0.00	-0.02 (0.01)	0.05**	0.00
info_access	-0.55 (0.30)	0.07*	-0.11	0.53 (0.27)	0.05**	0.13
male_hhh	-0.03 (0.25)	0.90	-0.01	0.08 (0.24)	0.75	0.02
education	0.24 (0.22)	0.28	0.05	-0.08 (0.21)	0.69	-0.02
membership	0.16 (0.11)	0.14	0.03	0.33 (0.10)	0.00**	0.08
years_in_area	0.01 (0.01)	0.15	0.00	0.00 (0.01)	0.61	0.00
relatives	-0.41 (0.21)	0.05**	-0.09	0.51 (0.20)	0.01**	0.13
affected	0.32 (0.57)	0.58	0.07	1.25 (0.59)	0.04**	0.29
affe_owner	0.32 (0.68)	0.64	0.07	-0.66 (0.67)	0.32	-0.16
boats	0.45 (0.86)	0.60	0.09	0.44 (0.82)	0.59	0.11
motorveh	0.60 (0.34)	0.08*	0.12	-0.45 (0.31)	0.15	-0.11
root_pci	0.00 (0.00)	0.21	0.00	0.00 (0.00)	0.38	0.00
sinhalese	0.28 (0.24)	0.24	0.06	0.35 (0.23)	0.13	0.09
buff_zone	0.34 (0.23)	0.13	0.07	0.42 (0.21)	0.05**	0.10
_cons	0.35 (0.61)	0.56		-0.71 (0.59)	0.23	-0.01

n=485 cases
** Significant at the 5% level; * significant at the 10% level
Source: Own calculations

Table A6: Factors influencing the probability of receiving tents and/ or tools and construction material (with variable buff_zone)

	tenttool			construct		
Variables	**Coef (Std. Err.)**	**P>|z|**	**Marginal Effect**	**Coef. (Std. Err)**	**P>|z|**	**Marginal Effect**
sea_exp	-1.14 (0.30)	0.00**	-0.28	-0.54 (0.52)	0.30	-0.03
ownership	0.31 (0.33)	0.35	0.08	0.23 (0.48)	0.63	0.02
house_damage	1.47 (0.29)	0.00**	0.32	1.08 (0.36)	0.00**	0.10
hhh_age	0.00 (0.01)	0.61	0.00	0.02 (0.01)	0.23	0.00
info_access	-0.04 (0.29)	0.88	-0.01	-0.34 (0.38)	0.37	-0.03
male_hhh	-0.12 (0.25)	0.65	-0.03	0.53 (0.42)	0.21	0.03
education	-0.17 (0.22)	0.46	-0.04	-0.66 (0.38)	0.08*	-0.05
membership	0.31 (0.11)	0.01**	0.08	0.01 (0.17)	0.96	0.00
years_in_area	0.01 (0.01)	0.14	0.00	-0.01 (0.01)	0.10*	0.00
relatives	0.24 (0.22)	0.27	0.06	0.22 (0.33)	0.50	0.02
affected	1.79 (0.73)	0.02**	0.36	-0.41 (0.88)	0.64	-0.03
affe_owner	-0.67 (0.81)	0.41	-0.16	1.12 (0.97)	0.25	0.12
boats	0.01 (0.80)	0.99	0.00	0.86 (1.16)	0.46	0.09
motorveh	-0.65 (0.34)	0.06*	-0.16	-0.36 (0.58)	0.53	-0.02
root_pci	-0.01 (0.00)	0.02**	0.00	-0.01 (0.01)	0.35	0.00
sinhalese	0.97 (0.26)	0.00**	0.24	-0.19 (0.36)	0.59	-0.01
buff_zone	0.80 (0.23)	0.00**	0.19	-0.27 (0.35)	0.45	-0.02
_cons	-1.61 (0.64)	0.01		-2.51 (0.94)	0.01	

n=485 cases
** Significant at the 5% level; * significant at the 10% level
Source: Own calculations

The following papers have been published so far:

No. 1	Ulrike Grote Arnab Basu Diana Weinhold	Child Labor and the International Policy Debate Zentrum für Entwicklungsforschung (ZEF), Bonn, September 1998, pp. 47.
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No. 4	Sabine Seibel Romeo Bertolini Dietrich Müller-Falcke	Informations- und Kommunikationstechnologien in Entwicklungsländern Zentrum für Entwicklungsforschung (ZEF), Bonn, January 1999, pp. 50.
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No. 6	Mingzhi Sheng	Lebensmittelhandel und Kosumtrends in China Zentrum für Entwicklungsforschung (ZEF), Bonn, May 1999, pp. 57.
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