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Coping with landslide risk through preventive resettlement. Designing optimal strategies through choice experiments for the Mount Elgon region, Uganda

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Landslides are a widespread phenomenon in the East African highlands, significantly reducing agricultural productivity and affecting rural income generating activities. In addition, the livelihoods of the poorest are most likely to be adversely affected by landslides. Traditionally, landslide risk is reduced by means of effective planning and management. However, in many regions, these measures are incapable to offer a long-term solution because of high population density and land shortage. Therefore, our paper uses a choice experiment to investigate whether preventive resettlement could be a feasible disaster risk reduction strategy for the population at risk in agricultural areas in Bududa district, East Uganda. Our study provides the first analysis of resettlement related preferences of people that are affected by environmental degradation. Our results enable us to assess community support for resettlement strategies ex ante and give valuable policy advice for future resettlement plans in a very cost-effective manner.

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1. Introduction

The increase in the frequency and intensity of natural disasters is worsened by both climate change and an increasing population living in high risk areas (Artur and Hilhorst, 2014; Rukundo et al., 2014; Black et al., 2011; WB/UN, 2010; Guterres, 2008). Since poor people tend to live on marginal lands that are most sensitive to natural hazards, they are most likely to be affected by small changes in climate variability (UNDP, 2004; FAO, 2000). One type of hazard with severe projected impact and widespread consequences are landslides. Landslides have a large social, economic and geomorphological impact as they significantly reduce agricultural productivity and increase soil degradation (Mugagga et al, 2012; Holcombe and Anderson, 2010; Claessens et al., 2007; Shiferaw, 2002). The entire East African Rift has been categorized as a region inherently susceptible to landslides because of high annual rainfall, steep and unstable slopes, and ongoing deforestation (Knapen et al., 2006; Glade and Crozier, 2004). Increasing population pressure is an important underlying factor, leading to slope disturbance, inconsiderate irrigation and deforestation. The poorest people are most likely to be adversely affected by natural hazards such as landslides since low agricultural income reduces the capacity to cope with risks (Vu et al., 2014; Dercon, 2006).

Effective planning and management, such as (geo-) technical measures, reforestation and development of warning systems, can substantially reduce the impact of landslides (Holcombe and Anderson, 2010; Dai et al., 2002). In many regions, high population density and land shortage make these measures insufficient to offer a long-term solution (Claessens et al., 2007; Knapen et al., 2006). Preventive resettlement from high-risk areas has been considered a possible disaster risk reduction strategy in response to increased natural hazards (Artur and Hilhorst, 2014; Claudianos, 2014; Correa et al, 2011). This requires financial and social capital and might only be feasible with governmental and non-governmental support, especially if high-risk areas have a high incidence of poverty (Lübken, 2012).

In this paper, we investigate ex-ante whether a preventive resettlement policy could be a feasible long-term risk reduction strategy to cope with landslide risk in the Mount Elgon region in East Uganda. We focus on the population at risk and the necessary conditions to design community supported resettlement strategies in this area. We consider resettlement as a key adaptation for managing natural and other risks, and thus not just as a problematic outcome of global environmental change (Black et al. 2011).

Our focus on the Mount Elgon region, and more specifically on the Bududa district in this region, is particularly relevant. The region as a whole and the Bududa district in

particular, are repeatedly hit by smaller and larger landslides, leading to severe calamity. The region is characterized by an increasing population density and a population that highly depends on the cultivation of land on steep slopes. The region stands as an example for the steep, highly weathered areas of the wet tropics that face a high population density and pressure. People encroach steep slopes and clear forest to get access to land for building their houses and generating an income through agriculture. These anthropogenic factors greatly contribute to the occurrence of landslides (Gorokhovich et al. 2013) which makes a focus on resettlement as a landslide risk reduction strategy pertinent.

We use a discrete choice experiment to examine whether resettlement is a feasible coping strategy to mitigate landslide risks on Mount Elgon, and if so under which conditions and compensatory schemes. This is a survey-based stated preference elicitation method that allows modelling preferences for hypothetical preventive resettlement strategies thereby revealing which strategies have a higher likelihood to be community supported. We also investigate whether the willingness to resettle depends on the landslide risk that the population currently faces.

Previous literature, especially the literature on development-induced forced displacement and resettlement (DFDR), identified two major problems with past resettlement policies. First, compensation alone does not work to restore people's livelihoods as it ignores the social and cultural consequences of displacement (Kabra and Mahalwal, 2014; Bui et al., 2013; Maldonado, 2012; Wilmsen et al., 2011; Cernea and Mathur, 2007; Webber and McDonald, 2004). Second, the majority of negative consequences following involuntary resettlement could have been prevented if projects had given room for greater community participation and consultation throughout the resettlement project design and implementation (Claudianos, 2014; Diduck et al., 2013; Brand, 2001). This paper incorporates these two perspectives. Through this first consultation round, we hope to limit the possible negative impacts of a non-targeted forced resettlement in the future by giving a platform for the peoples' voices to be heard and get insights into the preferences of the local population to shape this future strategy.

Our study provides the first ex-ante analysis of preferences for resettlement from environmentally fragile areas to create room for bottom-up policy planning. Our results enable us to give valuable policy advice for different resettlement policies which are not yet implemented in a very cost-effective manner. Through a well-designed preventive resettlement scheme, government can limit the elements at risk, thereby reducing the expected economic loss and loss of life due to landslides in the future.

2. Background

2.1 Description of area and landslides

The 274 km² research area of Bududa district is located in eastern Uganda on the southwestern foot slopes of the extinct Mt. Elgon volcano, 20 kilometers east of Mbale, a large trade hub (Figure 1). Bududa district was created in 2006 when it was separated from Manafwa district. The altitude ranges from 1300 to 2850m a.s.l. and the district has a wet tropical climate. The high average rainfall is 1800 mm per annum with two separated rainy seasons, one from March to June and the second from August to November. The average annual temperature is 23°C (BDPU, 2012) and is more or less constant the whole year round.

Topographic, climatic and soil conditions together with human presence make of Bududa district a landslide prone area[1] (Knapen et al., 2006). Most landslides occur on the east and north orientated slopes (dominant rainfall direction) with a rather small critical slope of 14°. Based on soil characteristics and past landslide experiences, the district can be divided in three zones (Kitutu et al., 2009) (Figure 1). The Central Bukigai zone is characterized by a carbonatite dome underneath the soils which is highly stable due to high cohesion of cementing minerals such as calcium carbonate (Kitutu et al., 2009). Landslides hardly occur in this zone. The second zone is the Western Bududa-Bushika zone. Different soil types are identified in this zone: Cambisols, Nitisols, Acrisols and Lixisols (Deckers et al, 1998). Landslides occur in this zone, but are relatively rare. However they contribute significantly to the landslide problem due to their large dimensions and the high population density of the area (Knapen et al., 2006). In the Eastern Bukalesi zone, soils have higher clay contents which lead to higher saturation rates of water. Landslides occur rather frequently and are shallower than in the Western zone because the parent material is nearer to the surface.

2.2 Agriculture and population pressure

Bududa has an estimated population of 182,867 people (BDPU, 2012), living in 16 sub-counties, including one town council. Agriculture is the most important economic activity for over 86% of the households living in the 16 different sub-counties (BDPU, 2012). The existing farming system is mixed crop-livestock farming. The main crops grown are banana, coffee, beans, cocoyam, cassava, sugarcane, onions and sweet potato. Coffee, especially

[1] Topographic conditions are related to slope steepness, climatic to the high annual rainfall and soil to the weathering and high clay content. The main impacts of human presence relate to cultivation, deforestation, and excavation for housing, agricultural activities, irrigation, and foot paths.

Arabica, is the most popular cash crop and almost all farmers are producing for the market. An average population density of 952 persons/km^2, rising up to more than 1300 persons/km2 in the densely populated parishes in the west, makes available land per household very small. A population growth rate of 5.6% since 1991 predicts even smaller land amounts per household and more cultivation of unstable, steeper slopes (sometimes steeper than 80%). Agricultural pressure and weak governance of land use will cause increased deforestation and excavations leading to a further reduction of slope stability in the future (Mugagga et al, 2012). Besides, due to climate change, the seasonal weather patterns are expected to become more extreme. On the one hand, this will strongly affect the way farmers can use their land and hence farmers' income and food security (Oxfam, 2008). On the other hand, it will increase the likelihood of a landslide occurrence. The interplay between high population density, land shortage, and climatic changes results in higher exposure to landslides. Therefore the economic risk by slope failure is projected to increase (Knapen et al., 2006).

2.3 Socio-economic impact of landslides

Landslides have a disastrous effect on the livelihoods of the farmers in Bududa district, resulting in income loss and loss of productive land (Rukundo et al., 2014; Gorokhovich et al., 2013; Jenkins, et al. 2013; Knapen et al., 2006). Farmers lose cash crops as most of the coffee and banana farming takes place on the steep concave slopes, ranging between 36° and 58° which are prone to slides (Mugagga et al., 2012; Kitutu et al., 2011). The debris of landslides imposes the government with direct economic costs related to the reconstruction of bridges, roads, dams and the obligatory funding of the disaster relief aid and displacement. The indirect costs such as decreased water quality and reduced land fertility can easily outweigh these direct costs (Knapen et al., 2006).

Generally, the catastrophic landslides follow after extreme rainfall events that can be attributed to global weather patterns associated with the El Niño Southern Oscillation. Knapen et al. (2006) describe the type of chain reaction that landslides can have on the livelihoods of Bududa people. In 1997, landslides killed at least 48 people, erased the crops and dwellings of 885 families, made 5600 people homeless, reduced the amount of arable land causing land-scarcity and property conflicts, polluted water supplies with a consecutive epidemic and hit Manjiya County with a food-shortage. More recently, in 2010, a major landslide triggered by heavy rains struck the village of Nametsi, killing over 300 people and affecting a population of about 10,000 people which needed to be evacuated to a UN-funded temporary camp in Bulucheke. This landslide eventually triggered the first permanent landslide induced

resettlement to Kiryandongo (Rukundo et al., 2014; Gorokhovich et al. 2013; Jenkins et al., 2013).

3. Preventive resettlement as risk reduction strategy

Disaster risk reduction strategies are being used to limit vulnerability and to strengthen institutions and communities for effective risk management. Landslide risk can be expressed in the following generic hazard-risk equation (Crozier and Glade, 2006):

Risk = hazard x vulnerability x elements at risk

This equation identifies the principal factors contributing to risk, where risk itself is defined as the expected loss in a unit of time. First, hazard consists of the probability that a damaging landslide of a given magnitude occurs. Second, vulnerability is expressed as the damage expected from the specified landslide magnitude. Last, the elements at risk represent the value of all elements at risk such as population, buildings, economic activities, public services utilities and infrastructure in the area.

Landslide risk reduction strategies emphasize preventive measures such as planning and awareness, land use planning and physical intervention in the territory to lessen both people's as well as infrastructure's exposure to natural hazards. Societies are becoming reluctant to invest in (geo-) technical measures that can reduce natural risks because of the high costs associated with these engineering and technical works (Guzzetti et al., 1999). These high associated costs make (geo-) technical measures such as slope stabilization less suited for large, environmentally degraded hillside areas in a developing context where governments are financially constrained.

Only recently, countries have opted for preventive resettlement as a disaster risk reduction strategy, especially if the risk to which a population is exposed cannot be mitigated by any other measure in a long-term sustainable manner. Preventive resettlement reduces the elements at risk, thereby decreasing one of the independent factors of the hazard-risk equation zero, and may even result in the nullification of the risk condition (Correa et al., 2011). Preventive resettlement to reduce exposure is suitable when (1) the local topography such as hillsides makes mitigation impossible, (2) there is a clearly defined area at risk of landslide, and (3) the most at risk communities can be identified to be resettled (Claudianos, 2014). Moreover, if resettlement wants to be successful, it should form part of a comprehensive disaster risk reduction strategy controlling human settlement in unsuitable areas and human activities that exacerbate natural hazards (Correa et al., 2011).

4. Methodology and data

4.1 Resettlement Assessment through Discrete Choice Experiments

To assess individual's preferences for preventive resettlement strategies we rely on a discrete choice experiment (DCE) introduced by Louviere and Hensher (1982). This is a survey-based stated preference elicitation method that allows modelling preferences for hypothetical resettlement strategies and thereby revealing which strategies have a higher likelihood to be community supported. In a DCE respondents are presented with several choice sets that include alternative varieties of a good or service – in this case a resettlement strategy - differentiated by their attributes and attributes levels, and asked to select their most preferred alternative. A baseline alternative, corresponding to the status quo or 'stay on-site' situation is included in each choice set in order to interpret the results compared to the current situation. At least one attribute of the alternative is systematically varied across respondents so that preference parameters of an indirect utility function can be inferred (Carson and Louviere, 2011).

DCE rely on random utility theory which states that a respondent's utility function is comprised of a deterministic, observable component (V) and a random, unobservable component (ε) (Christie et al., 2004):

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} = \beta X_{ijt} + \sigma_i X_{ijt} + \varepsilon_{ijt} ,$$

Where U_{ijt} represents the utility a respondent i derives from choosing alternative j on choice situation t, X_{ijt} is a vector of k observed attributes for the resettlement strategies (k being the number of attributes), β is the vector of preference parameters associated with the attributes, σ_i is a vector of k standard deviation parameters, and ε_{ijt} is a stochastic error term, independently and identically distributed (iid) according to a Gumbel distribution (Louviere, Hensher & Swait, 2000). One choice set comprises of several resettlement scenarios. Choosing one alternative over the others implies that the utility of the chosen alternative exceeds the utility derived from the other alternatives (Ben-Akiva & Lerman, 1985). Respondents' preferences are generally estimated through maximum likelihood in logit models (Ben-Akiva & Lerman, 1985). Parameter estimates are derived from the log-likelihood function associated with the logit model.

4.2 Choice Experiment Design

To assess individual preferences for resettlement plans we conducted a survey that included socio-demographic questions as well as a choice experiment. The construction of a choice experiment includes three important stages: the identification of the attributes describing the alternatives within each choice set, the identification of the attribute levels and the experimental design. To identify the attributes, semi-structured interviews were conducted among six sub-county chiefs, an officer of the Office of the Prime Minister and the National Environmental Management Authority. In addition, four focus-group discussions (FGD), each consisting of five women and five men, were organized. In Nametsi and Bukalasi sub-county one FGD was organized while in Bibiita sub-county two FGD took place. Finally a workshop was organized in Mbale with the aim of testing the feasibility of the attributes and the attribute levels which were identified as important during the semi-structured interviews and FGD. All sub-county chiefs as well as representatives of the Red Cross, the Ugandan Wildlife Authority, the District of the Local Governments and the UNDP were invited to participate in the workshop. A screening of the resettlement literature together with the information gathered during the interviews, the FGD and the workshop allowed identifying six resettlement attributes and the relevant attribute levels (Table 1). Twenty-four choice cards divided over two blocks were designed using the NGene software and tested in a pilot survey which allowed to further fine-tune the survey and choice experiment. An example of a choice card is shown in Figure 2.

4.3 Choice Experiment Procedure and Sampling

During the period August – October 2013, we interviewed 307 household heads in Bududa district. The last population census was carried out in 2002 and population predictions were established for the next ten years. These predictions consist of detailed population estimations for each sub-county, and the total population of Bududa district was estimated at 182,867 in 2012. The numbers for each sub-county were consequently used and projected on a target sample of 300 respondents. The amount of respondents interviewed in each sub-county is therefore proportional to the sub-county's population size. The final survey was carried out in two randomly selected villages in every sub-county and one town council of Bududa district. This sampling method enables us to use a random and proportional sample that takes into account the different landslide risk and susceptibility zones of Bududa district.

The duration of one interview including the choice experiment and the survey questionnaire took on average thirty minutes. Each time a translator started with a small

introduction to emphasize that the research was conducted independently and was not issued by or linked to a governmental body. Second, each attribute with its levels was thoroughly explained, to make sure that the respondent understood everything. Just before the experiment started, the translator reminded the respondents of three issues which were important to conduct the choice experiment correctly. First, if he chooses one of the two scenarios, he agrees to relocate to a new house in a new location. He will remain owner of his land but he is no longer allowed to live on it. Second, if none of the two scenarios convinces him to consider a resettlement in the future, he can choose to stay under the same conditions and face the landslide risk with the potential consequences in the future. Choosing for the status-quo is not a choice against a resettlement, but only indicates that he finds the given scenarios insufficient to consider a resettlement. Finally we included a 'cheap talk' script. People sometimes answer in a way that they think will influence government's future decisions or give answers to please the interviewer. A method to diminish this kind of biases is cheap talk (Cummings and Taylor, 1999). Cheap talk is included to convince the people to think carefully about whether they really would do what they say and to answer as if this was a real choice with real consequences. To make sure that the person understood the choice experiment, we first gave him a test card. The test card had the same structure as the twelve choice cards which followed. If the interviewer noticed that anything was unclear, he explained the procedure again until the participant felt comfortable to start the experiment.

5. Choice experimental results

5.1 Descriptive statistics

In Table 2 we summarize the main sample characteristics. Descriptive statistics are given for the full sample as for the at risk population and low risk population groups. This subdivision is based on two key variables related to landslide risk. The first variable is the self-reported steepness of households' agricultural land as this is a key precondition factor for a landslide to occur[2]. Within one of the three areas classified by Kitutu et al. (2009), there are still large variations in landslide risk and a regional variable would therefore not be able to capture this variation in landslide risk. The second variable is whether a landslide already occurred in a village. This variable measures the factual (more chance that another landslide happens) and perceived likelihood that a landslide will happen in their surroundings. These

[2] In case participants had multiple scattered plots, we asked them to record the steepness of their agricultural land where their house was located. So steepness records both the steepness of the location of their house and their surrounding plots.

two variables constitute an ideal interplay between objective facts and own perception which both have been shown to influence choice behaviour in other fields (Baker et al., 2009). We allocate people living on steep slopes or people living in a village where a landslide already happened to the at risk population group (n=203). People that live on flat or gentle slopes and never experienced a landslide in their village are allocated to the low risk population group (n=104).

Looking at the socio-demographic characteristics, some important inferences can be made dependent on the riskiness of the respondents' own land. First, people living in the riskier areas are significantly younger compared to people living in the low risk areas[3]. Second, there is an inverse relationship between household income and the riskiness of the household's land. People who live in the low risk areas have a significantly higher income than people living on riskier land. Further, households in the high risk areas have a significantly larger size, own less livestock unites, are more likely to live in a semi-permanent house (hut) and have an illiterate household head. Farming is the main income generating activity and almost all farmers cultivate coffee. Concerning resettlement attitude, as a first indication, seventy-three percent of respondents expressed a willingness to resettle which was defined as willing to leave current land and get new safer land elsewhere. This number increases significantly to eighty-nine percent for people living in risky areas. Finally, eighty-four percent of respondents in our sample were willing to give up part of their agricultural land to mitigate landslide risk.

5.2 General random parameters model

The results of estimating the random parameter logit model for the full sample are reported in Table 3. The significantly positive coefficient of the alternative specific constant *Resettlement* (coded as 1 for resettlement and 0 for staying in their current house) implies that there is a general willingness to resettle compared to keep on living in landslide prone areas. People prefer to receive a monetary compensation, and the more the better. There is a strong willingness to be resettled within the Bugisu region, and especially within Bududa district compared to being resettled outside their culturally similar Bugisu area. This could indicate that people do not want to be resettled outside their ancestral and cultural grounds due to the strong land attachment. Moreover, if they are resettling not too far away from the land they are currently owning and cultivating, the household can still keep on generating an income

[3] Differences in continuous variables were tested with two sample t-tests with unequal variances while Pearson chi-square tests were run for categorical variables.

from this land by for example cultivating it more extensively. For the housing attribute we find that both barracks and a single house are less preferred than being resettled into a multi-story building. This result might seem surprising at first. However a couple of explanations could be hypothesized. First, respondents might link the construction of flats to a general development of the area (increase in services) since electricity, running water, etcetera are needed to be constructed when people live in multi-story buildings. Second, due to the population pressure in Bududa district, people may realize that there is no space to resettle into a single house within the area. Last, from government consultations we inferred that government plans are being developed to create semi-urban centers in flat areas to absorb the population that lives on the steep slopes. It could well be that these government plans already circulated among the affected population. Both health center and schooling attributes are insignificant for the respondents although these attributes were put forward as important in the focus group discussions. It seems that when asking people to make a resettlement choice and trade-off different attributes against each other, health and schooling services become of secondary importance compared to other attributes such as the new location of their house and compensation. Besides, this dominance can also be explained by a gender effect as 93% of our respondents are male. Finally, regarding the land compensation, they prefer to be compensated with the same amount of land as they were holding before the resettlement which confers with the World Bank land for land swap policy.

5.3. Split sample results: at risk versus low risk population

Although the full model can give us general insights, it is important to understand whether the willingness to resettle is dependent on the probability of a landslide occurring and whether preferences differ under these different landslide risk situations. The significant standard deviations of the parameter distributions show that preference heterogeneity is present for all normally distributed random parameters. Therefore, to exploit this heterogeneity, we run a split sample model based on two key variables linked to landslide risk and subdivide our sample into at risk population and low risk population[4].

Results of the split sample random parameter model (Table 3) show that the respondents' choice behaviour is dependent on the likelihood of a landslide occurring. This means that landslide risk significantly affects people's willingness to resettle. People living in the riskiest areas have a strong willingness to resettle independent of compensation. The low risk

[4] We ran split sample models since latent class models did not give interpretative results due to the variance matrix being non-symmetric or highly singular.

population group has no willingness to resettle (insignificant ASC) unless they receive a high compensation in terms of money and land.

When we control for income, age and type of dwelling in our regression analysis[5], it becomes clear that people want to keep their current level of livelihood. Older people, people with a higher income or living in a permanent house are significantly less willing to resettle and ask a significantly higher compensation. The socio-economic profile of the at risk population differs significantly from the low risk population (Table 4). Households that are at risk are significantly younger, are larger in size, cultivate more land on steep slopes, have less income, live more frequently in semi-permanent huts and have a higher incidence to be illiterate.

5.4. Attribute importance

Usually, researchers calculate willingness-to-pay/willingness-to-accept (WTP/WTA) measures in order to compare and interpret the results in standard welfare economic terms[6]. We chose not to do so for several reasons. First, our choice experiment model of resettlement captures a mixture of WTP/WTA which depends on the respondent's perceived landslide risk as well as the risk associated with resettling and this can confound welfare estimates. On the one hand, people should be willing to pay for a future scenario in which they are unexposed to landslide risk. On the other hand, resettlements embody negative impacts on people's lives physically, economically, socially and culturally (Maldonado, 2012). People opting for resettlement should be compensated for these potential losses. Second, the status quo or baseline scenario is different for every respondent making it difficult to estimate accurate welfare estimates as we did not use a pivot design. Third, we do not want to put a price-tag on human lives (Maldonado, 2012). We thus feel it is unethical to report biased willingness-to-accept estimates if these in turn would be used in a future resettlement scenario to compensate the Bududa people.

Instead, we calculate attribute importance so that preferences of the at risk population and the low risk population can be interpreted and compared for the different resettlement attributes in non-monetary terms (Lizin et al., 2012)[7]. Attribute importance signals the relative

[5] Authors can be contacted to share these results with interested readers.
[6] You cannot compare parameters directly between logit models because the numerical values of the parameter weights are confounded with a scale parameter (Swait and Louviere, 1993).
[7] Attribute importance can be calculated as follows: (1) calculate the utility range per attribute, (2) sum up the utility ranges and (3) divide the attribute utility range by the sum of the utility ranges.

contribution of each attribute to the overall utility for each respondent. Table 5 shows the attribute importance for the general model, and the at risk and low risk groups.

Respondents attach the highest importance to the resettlement location attribute within the three models However, the general willingness to resettle and importance of monetary and land compensation clearly differ between the two subsamples. Those who experienced a landslide in their village or live on steep land are more willing to resettle while monetary and land compensations contribute less to their overall utility compared to low risk groups. Attribute importance scores confirm that landslide risk significantly affects the relative contribution of a resettlement to the overall utility of each respondent. For the at risk group, resettlement gets a factor loading of sixty percent compared to two percent for the low risk population groups. On top of that, the compensation asked differs significantly with landslide risk. Less monetary compensation is asked by people living on steeper slopes or by people that have experienced a landslide in their village in the past. The proposed amounts of monetary compensation (1%) do not influence their choice for a future resettlement scenario. The minor importance of monetary compensation can be an indication that the at risk population assesses the extent of future income losses due to landslides as being very high. Their choice is driven by the location to which they will be resettled (23%), the amount of land they will get after resettlement (8%) and the opportunity to have improved access to education services (7%). This shows that it is not a solution to send them to a destination outside Bugisu, even when you compensate them with money. Other factors such as the cultural region and the possibility of improved social services contribute more to their overall welfare.

6. Discussion: accounting for challenges to implement preventive resettlement

Our choice experimental results relate to empirical findings from the wider resettlement and migration literature. One of the main problems of involuntary resettlements in the last 20 years is related to the over-reliance on compensation alone to restore people's livelihoods, ignoring the social and cultural consequences of displacement (Maldonado, 2008; Cernea and Mathur, 2007). The cultural and emotional attachment to a place is often one of the most important reasons to stay even if people's livelihoods are threatened by natural hazards (Lübken, 2012; Berg, 1999).

According to our study, the resettlement location would be the most important attribute for a future resettlement to be successful. This location preference is linked to the Bududa people's attachment to place. Both economic as well as anthropologic factors explain why

they prefer to be resettled within the culturally similar Bugisu region. Soil fertility is an important economic factor as the volcanic soils combined with the abundant rainfall create very fertile soils for farming. These soils serve as protection against food insecurity and ensure that people are able to grow cash crops such as coffee in order to generate an income. The familiarity with the climate and the resulting agricultural practices that have been handed down by generations results in a strong land attachment. Bududa people have a strong cultural attachment to their place, as this place is linked to their language, the cultural acceptance of polygamy and the cultural tradition of male circumcision. These cultural habits are been frowned upon by other population groups in Uganda and people therefore fear to lose their license to practice their cultural values once they are resettled outside the Bugisu region. Bududa people often put historical attachment to their ancestral land forward as the main reason to keep on living on the steep slopes of the Mt Elgon volcano. These ancestral values pertain to former family members being buried on their family land as well as ancestral sayings such as "If you resettle, never go down, always go up." The importance of this driver is confirmed by a quote in the Ugandan Daily Monitor. After a landslide displaced around 3000 people in Bushiyi sub-county in August 2013, the newspaper quoted: "*Some hesitated, preferring they would rather die on their fertile ancestral land to which they profess a sturdy bond*".

Beside the fact that compensation alone will not work for the high risk group, our study shows that legacy issues matter when it comes to the relationship and trust between the government and affected communities (Correa et al., 2011). People in Bududa were asked whether they considered the risk related to a resettlement to be higher or lower than the risk of a landslide. Sixty-one percent of respondents indicated that they perceived a resettlement to embody a higher risk than to stay living in the landslide prone area. In several focus group discussions it became clear that people rationally weighted the pros and cons of a resettlement against the likelihood of a landslide occurrence. The fact that sixty-one percent of respondents considered it more likely that their livelihoods would be negatively affected by a resettlement than by a landslide originates from the negative perception of the first landslide induced resettlement by the Ugandan government in 2010. This resettlement took place after a landslide killed more than 350 people in the village Nametsi (see Figure 3 for an impression). More than 600 households (4031 people), were resettled far from their native places to Kiryandongo in Midwestern Uganda, a culturally and geographically different region which was previously used as a refugee destination. The government pledged to provide housing and land, and to assist to rebuild their livelihoods.

An on-site analysis of this previous resettlement by the authors with the Impoverishment Risks and Reconstruction model of Cernea (1997) showed that essential resettlement risks where not adequately tackled and there were significant performance problems in implementing the pledges. Promises such as the construction of a house for each household were only partially kept, as only 100 of the promised 650 houses were built in 2013 (Jenkins et al., 2013). Internally displaced people (IDP) were not consulted and there was a clear lack of participation in the resettlement process. IDPs got 2.5 acres of land but reported that the land basis was not enough to generate a steady-income. They were not familiar with the climatic conditions and they received land of inferior quality. They did not receive training in agricultural practices to cultivate these inferior soils. The resettlement scheme is not recognized by the government as an administrative unit and has no legal voice to reflect IDPs' interests so that IDPs feel deserted. Since IDPs re-habit an old refugee camp, this deserted feeling is reinforced with a feeling of injustice and depreciation of self-image. Agencies provided seeds and seedlings for the first agricultural season, but rebuilding regular food production capacity at the site may take years due to long droughts. IDPs have limited access to the market as they cannot afford the price for a market spot which makes it difficult to generate any income. Many IDPs live in absolute poverty margin. Because of this, many IDPs returned to Bududa and spread the negative experiences they encountered during the resettlement. This consequently affected people's perception throughout the Bududa area. This confirms that governments' past actions have a negative effect on people's perceptions and trust which can be seen as a reputation cost for the government. Linking back, our experimental findings highlight why this previous resettlement was a failure. Respondent's strongest preferences were ignored by government next to the severe lack of implementation. Beside, Bududa people expressed a large willingness (92%) to be involved and consulted if government wants to drastically change their lives and livelihoods.

7. Conclusion and policy recommendations

In this study, we use a discrete choice experiment to examine whether a resettlement is a feasible strategy to mitigate landslide risks on Mount Elgon, and if so under which conditions and compensatory schemes. Besides we investigate whether the willingness to resettle depends on the probability of a landslide occurring. We model heterogeneity in these preferences using a random parameters logit model and a split sample approach.

We find considerable heterogeneity in the willingness to resettle, with people living in the most landslide-prone areas most willing to resettle. Significantly less compensation is

asked by people living on the steepest slopes or in a village that has been hit by landslides in the recent past. The willingness to resettle significantly increases with the amount of monetary compensation and the acreage of land that resettled households would have access to after resettlement. This creates scope for smaller but targeted resettlement programs in which only people in the most landslide-prone zones are subject to resettlement. Resettlement is likely to be most effective if resources are used to decently compensate a smaller number of the most vulnerable households – rather than to focus on a wider resettlement zone and lower compensation.

The households living in the most landslide-prone zones and faced with the highest landslide risk are poorer and younger households. As arable land is becoming increasingly scarce, newly established households are pushed to frontier areas in search for land and the poorest households are pushed to steeper, unstable slopes because they are bid out in the land market. Given that these poorer and younger households are more willing to resettle, also against a lower compensation, entails an opportunity as well as a threat. The fact that households in high-risk zones can be resettled at the smallest compensation increases the financial feasibility of resettlement. Also the resettlement of younger families, who are likely to increase in size, could provide a more long-term and structural solution to curb future population pressure on unstable slopes. The threat is that cheap resettlement, with too low compensation and lack of guidance in destination areas, further impoverishes and marginalizes the most vulnerable households. While resettlement may reduce landslide risk, it poses increased social and economic risk in the destination area (Owen and Kemp, 2014; Wilmsen et al., 2011; Stal and Warner, 2009; Schmidt-Soltau and Brockington, 2007; Cernea and Schmidt-Soltau, 2006). We stress the importance of government paying equal attention to eliminating any social vulnerability in destination areas and provide policies for alternative livelihoods.

We find that the destination location of resettlement strongly influences the willingness to resettle. Although the willingness to resettle in our general model is significantly positive, the respondents have a high preference for resettlement within the Bududa district or at least within the wider, culturally similar, Bugisu region. Resettlement within the same district or region might also be preferable from a socio-cultural point of view and limit the likelihood of social disruption and marginalization of resettled households. Yet resettlement, especially large resettlement programs involving a lot of households, within the district or region is not straightforward because of high population pressure and increasing land shortage in the whole region (Claessen et al., 2007; Knapen et al. 2006). Finding a

suitable destination area within the region is difficult, which limits the possibilities for resettlement. This again calls for the careful resettlement of targeted groups of people from the most risky areas. Although not directly resulting from our study, we need to note that such resettlement is only meaningful if it is followed by a delineation of the high-risk zones people are resettled from and prevention of new encroachment in these areas. We invite future researchers to accurately identify the high-risk zones and suitable destination areas taking into account our ex-ante recommendations.

Through analysis of the preferences of the population at risk, we actively engage the communities to participate in the resettlement process and find ex-ante evidence that a combination of compensation and a people-centered, development approach will give the best results. The choice experiment and accompanying survey clearly show that government should include the cultural and social dimensions of the Bududa people, next to monetary compensation. On top of that, due to legacy issues, the government will need to improve its relationship with the affected communities to rebuild trust and reverse the negative perception of the previous resettlement if they want to use preventive resettlement as a successful risk reduction strategy in the future.

Our results and the derived implications show that ex ante choice experiments have merits in understanding resettlement preferences and the heterogeneity in these preferences across households, and in the design of effective resettlement policies. We can limit ex-post resettlement risks using the choice experiment as ex-ante impact assessment tool for future risk reduction strategies. Representing alternative livelihoods by six attributes and twelve choice cards in a choice experiment is of course a simplification of reality. We acknowledge that our choice experiment does not take into account the complexity of resettlement and the links between different economic, anthropologic, and environmental factors that influence households' preferences and decisions. It might have been difficult for respondents in our choice experiment to deliberate the given alternatives and make a hypothetical choice. Several authors have argued that thinking about uncertainty, probability and risk is not straightforward (Trope and Liberman, 2003; Kahneman and Tversky, 1984). Despite these limitations, we believe that choice experimental research can result in complementary insights in the debate about environmental risks and its policy solutions. Particularly the ex-ante nature of this type of research has a merit in assessing policies and strategies before they are actually implemented. It is a relatively easy-to-implement and low-cost method to assess ex ante community support for resettlement – and potentially also other environmental-risk reduction – strategies.

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Tables and Figures

Table 1. Attributes and their corresponding attribute levels

Attributes	Levels	Explanation/Background
Location	Same sub-county	Within sub-county, but different location
	Within Bududa district	Same district, but different sub-county
	Within Bugisu region	Same region, but different district
	Outside Bugisu region	*Outside their cultural region, anywhere in Uganda*
Housing compensation	Single house	Permanent single house
	Baracks	Multiple attached single houses
	Multi-story	*Multi-story building*
Health services	Health Center 4	Highest level of health services (hospital)
	Health Center 3	Intermediate level of health services
	Health Center 2	*Lowest level of health services*
Education services	Primary + Secundary+ Vocational	Highest level of education services
	Primary + Secundary	Intermediate level of education services
	Primary	*Lowest level of education services*
Monetary compensation	250.000UGX for 12months	Average income of a Ugandan is
	250.000UGX for 6months	UGX 336,900 per month
	250.000UGX for 0 months	
Land compensation	Same amount of land	Same amount as you possessed before (WB-policy)
	Half the amount of land	Half the amount, you possessed before
	No amount of land	*No amount of land will be compensated*

Table 2. Summary statistics for full sample and subsamples

Characteristics	Full Sample	Low risk	At risk
Socio demographics			
N° of Respondents	307	104	203
% of male household heads	93%	94%	93%
Age of the household head (years)	42	43	40***
Average household size	7.9	7.4	8.1***
Literacy rate	54%	63.5%	51%***
Households with farming as main occupation	83%	83%	83%
% of farmers growing coffee	94%	93%	95%
Monthly income (UGX)	387.452	424.182	368.634***
Land cultivad (acres)	2.39	2.27	2.45***
Average livestock holdings (LU)	2.05	2.15	1.95***
Households living in semi-permanent house (hut)	81%	72.5%	84%***
Resettlement attitude			
Households willing to resettle	73%	61%	89%***
Households willing to give up land to reduce landslide risk	84%	83%	88%

*** significant at 1% level. Differences in continuous variables were tested with two sample t-tests with unequal variances while Pearson chi-square tests were run for categorical variables.
LU = Livestock Units.

Table 3. Random parameter logit model results for both the general model as the risk population groups.

	General Model		At risk population		Low risk population	
Variables	Coeff.	Se.	Coeff.	Se.	Coeff.	Se.
Resettlement (ASC)	**0.990*** **	(0.159)	**1.940*** **	(0.200)	**-0.0185**	(0.317)
Monetary comp	**0.0988*** **	(0.000)	**0.0427***	(0.0234)	**0.243*** **	(0.0458)
Bugisu region	1.476***	(0.141)	1.165***	(0.129)	1.889***	(0.307)
Bududa district	1.873***	(0.160)	1.932***	(0.168)	2.255***	(0.351)
Sub-county	1.732***	(0.161)	1.502***	(0.163)	1.761***	(0.312)
Barracks	-0.226***	(0.085)	-0.144*	(0.0840)	-0.407**	(0.168)
House	-0.186**	(0.089)	-0.127	(0.0881)	-0.349*	(0.204)
HealthCenter3	0.000978	(0.089)	0.0232	(0.0882)	-0.0733	(0.178)
HealthCenter4	0.0307	(0.083)	0.0552	(0.0854)	-0.136	(0.191)
Prim+Sec	-0.0936	(0.082)	-0.0710	(0.0833)	0.0585	(0.163)
Prim+Sec+Voc	0.121	(0.086)	0.165*	(0.0886)	0.0276	(0.199)
Half land	0.217**	(0.106)	0.109	(0.0976)	0.533**	(0.250)
Same land	**0.516*** **	(0.109)	**0.366*** **	(0.103)	**0.858*** **	(0.257)
SDbugisu	1.645***	(0.154)	0.991***	(0.154)	2.403***	(0.299)
SDbududa	2.389***	(0.198)	1.484***	(0.175)	2.594***	(0.310)
SDsubcounty	2.020***	(0.165)	1.586***	(0.180)	2.631***	(0.316)
SDbarracks	-0.594***	(0.127)	-0.231	(0.201)	0.677**	(0.298)
SDhouse	0.666***	(0.117)	0.309*	(0.179)	-1.272***	(0.232)
SDHC3	0.625***	(0.131)	0.374**	(0.154)	0.580***	(0.201)
SDHC4	0.394***	(0.142)	0.0818	(0.200)	-0.866***	(0.181)
SDPS	-0.527***	(0.121)	-0.356**	(0.156)	-0.551**	(0.280)
SDPST	0.398**	(0.166)	0.343***	(0.121)	-0.756***	(0.204)
SDhalfland	0.913***	(0.122)	-0.306*	(0.164)	1.372***	(0.262)
SDsameland	0.939***	(0.115)	0.449***	(0.124)	1.662***	(0.263)
Log Likelihood	-2649.9		-1631.4		-919.1	
McFadden R^2	0.359		0.397		0.337	
Observations	11,052		7,308		3,744	

Note: *** significant at 1% level. SD: standard deviations of random parameters. Both ASC and price attribute are kept non-random. Models have been estimated with 500 Halton draws and random parameters are assumed to follow a normal distribution. All variables were dummy coded.

Table 4. Socio-economic profile of at risk population

Age of HH head	-0.0210***	(0.00165)	In years
Household size	0.0741***	(0.00608)	In numbers
Land cultivated	0.0752***	(0.0106)	In acres
HH monthly income	-9.53e-07***	(6.79e-08)	In 100,000 UGX$
Dwelling type	0.778***	(0.0527)	1=semi-permanent
Illiteracy	0.752***	(0.0437)	1=illiterate
Constant	-1.323***	(0.133)	

Multinomial logit regression: at risk population on low risk population; Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 5. Attribute importance for general model and risk population groups.

	General model (n=307)	*At risk population (n=203)*	*Low risk population (n=104)*
Resettlement	44%	59%	2%
Monetary compensation	13%	1%	20%
New location	18%	23%	40%
Housing type	2%	1%	5%
Level of health services	1%	1%	5%
Level of education services	9%	7%	3%
Amount of land compensation	13%	8%	26%

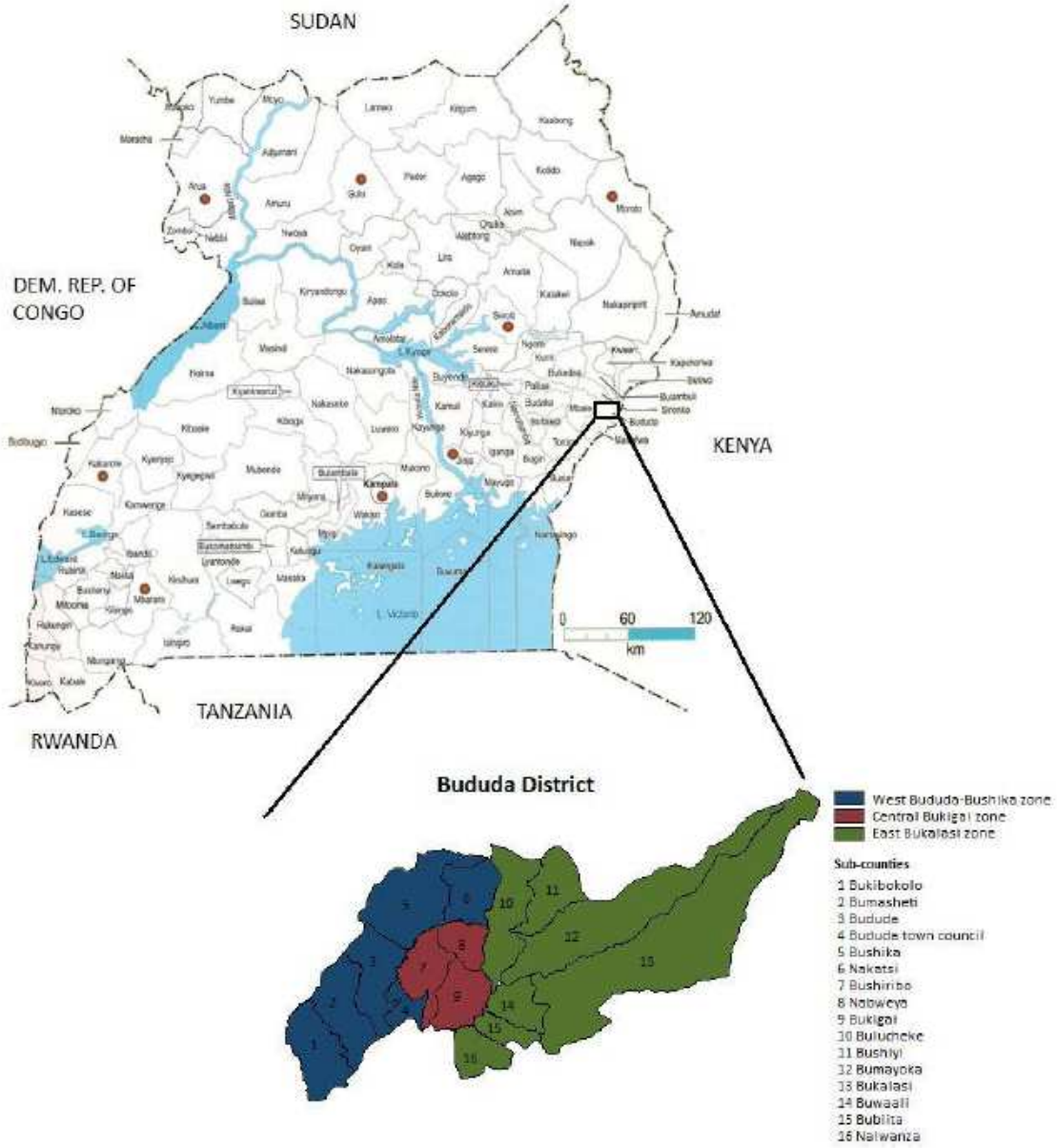


Figure 1. Location of the study area, Bududa district, in Uganda

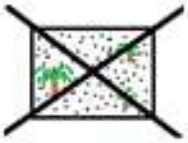
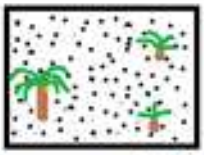
	Resettlement 1	Resettlement 2	None of the two
Location	In Bududa district	In Bududa district	I choose none of the two resettlement strategies
Housing	 Single House	 Barack	
Health	Health Center 2	Health Center 4	
Education	 Prim+Sec+Voc	 Prim	
Land compensation	 No amount of land	 Same amount of land	
Monetary compensation (250.000USh/month)	 0 Months	 12 Months	

Figure 2. Example of a choice card with two resettlement scenarios and a status quo.

Figure 3. Nametsi landslide 2010 in Bududa district. (courtesy of Global Post, http://www.globalpost.com/photo/5709328/uganda-landslide)