

# To Help or Ostracize? the Victims of Unexploded Ordnance from the Vietnam War in Northern Lao

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# To Help or Ostracize? the Victims of Unexploded Ordnance from the Vietnam War in Northern Lao\*

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## Abstract

Lao PDR inherited from the Vietnam war the most unexploded ordnance (UXO) contamination per capita in the world. Casualties still amount and even the survivors suffer serious disability. Recently, villagers are seriously injured and disabled by UXO in a village called Phonxay in northern Lao near the Vietnam border. As a small step in devouring causation between the heritage of Vietnam war and the affected people's livelihood and wellbeing, this short paper aims to identify a causal relationship between UXO impacts and intra-village inter-household trade of locally produced products by using primary data obtained in this UXO-contaminated remote village. The paper identifies that the UXO-affected households give and receive significantly smaller amount of locally-produced commodities to/from others. This negative impact of disability on within-community trade suggests that, in the UXO-affected village it is difficult to expect autonomous cooperation and support for those disabled villagers from others; in other words, they are economically ostracized.

JEL codes: R11, N45

Keywords: Unexploded ordnance, Vietnam war, Lao PDR

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# 1 Introduction

The Vietnam War was by far the most severe bombardment case in human history. According to Clodfelter (1995), US and allied air forces, along with U.S. Navy and Marine Corps dropped a total of 7.5 million tons of bombs and other ordnance during 1964 and 1973. This tonnage amounts three times that of World War II and the Korean War combined. Lao PDR<sup>1</sup> has unenviable distinction of being the most severely contaminated nation by unexploded ordnance (UXO) from the Vietnam war. More than a quarter of those bombs and ordnance were dropped over the country, and many are still in the ground as UXO. Casualties amounts well over 50 thousand. Though its rate is decreasing, the number is still growing by hundreds every year.<sup>2</sup> Even the survivors still suffer serious disability. We expect our community to help those members who are disabled unexpectedly and people to be altruistic especially to those handicapped with misfortune, and we do not expect reciprocity from them. This paper shows that this common virtue in the developed hemisphere does not apply in a UXO-contaminated poor village called Phonxay in Lao PDR located near the northern border to Vietnam. There, households with their heads disabled by UXO are ostracized economically.

Of those 124 households in the Phonxay village, two have their household heads seriously injured and disabled –one lost his leg, and another lost his sight– by unexploded ordnance dropped by the U.S. and allied air forces during the Vietnam war. Using primary data of inter-household trading of locally produced commodities in this village, we identify that the UXO-affected households give or receive significantly smaller amount of locally produced commodities to/from others. This negative impact of disability on within-community trade suggests that, in the UXO-affected village it is difficult to expect autonomous cooperation and support for those disabled villagers from others.

The National Socio-Economic Development Plan (NSEDPlan) of the Government of Lao PDR identifies the correlation between the presence of UXO and the prevalence of poverty; poor districts are most often the ones impacted by the presence of UXO. Besides, Via and Zinnert (2016) review the findings that contaminants from bombing alter plant composition and subsequently modify a large scale ecosystem in the affected area. Durham et al. (2016) claims that unexploded ordnance clearance enhances livelihoods in Lao PDR, by means of an interpretive case study design. Manolom and Promphakping (2016) argue through qualitative methods that reducing the impact of UXO on communities will enhance human wellbeing as stipulated in the Millennium Development Goals specifically to Lao PDR.

However, causation between the bombardment in Vietnam war and poverty is yet to be identified. By using a U.S. military dataset of 584 districts, Miguel and Roland (2011) found no evidence of U.S. bombing

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<sup>1</sup>Lao People's Democratic Republic.

<sup>2</sup>See Project RENEW Report (2004) for the case of Vietnam.

causing negative impacts on consumption levels, infrastructure, literacy or population density, concluding that even the most intense bombing in human history did not generate local poverty traps in Vietnam.<sup>3</sup> Given the broader perspective of devouring causation between the heritage of Vietnam war and the affected people's livelihood and wellbeing as its backdrop where the evidence is still limited, this short paper aims to identify the causal relationship between UXO impacts and economic ostracization in northern Lao. To attain this goal, we investigate the UXO-affected households' inter-household trade of locally produced products in a UXO-contaminated village named Phonxay, by using an original dataset consisted of all household pairs within the village (N=15,252).

US bombardment in Northern Lao was a mixture of both strategic and interdiction bombing. Geographical deviations in bombing intensity and types of bombing exist at the country level, or even at the district level. However, it does not at the village level; UXO are found everywhere in the contaminated village, e.g. village centres, lowland and upland rice fields, and forest areas, and therefore, predicting an accident is very difficult (Lao National Unexploded Ordnance Programme, 2012). Besides, Nalty (2000) reports that local population density is not correlated to bombing intensity. These facts allow us to interpret that the tragic event of being a UXO victim in this village is essentially a random event.

While relatively larger amount of studies analyzes the *causes* of war in the literature, *consequence* of war is analyzed to a much lesser extent.<sup>4</sup> On one hand, the theoretical literature concerning the impact of war and military conflict on economic well-being or growth evolves around the "conflict trap," implying that the war damage to the capital stock obstacles the economic growth for a prolonged period.<sup>5</sup> On the other hand, little empirical study is conducted in the literature with respect to the economic impact of war. As pointed out by Miguel et al. (2004), this is mainly due to the difficulty of conducting sound causal inference and more fundamentally, lack of data. The current paper, however bypasses these issues by collecting original data at the village level, which is geographically minute enough to regard the risk of UXO damage to be uniform across the area.

In our analysis, inter-household trade to and from the UXO-affected households consist a treatment group while those among other households consist a control group. Our results show that UXO-affected households trade strictly smaller amount of those goods such as livestock than other households do, and moreover that the amount is never greater for any other good, too. Results also show that UXO-affected households never receive any more than other households do in return for what they give to others, i.e., they receive less, as they

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<sup>3</sup>In a different Pacific theater, for example, Davis and Weinstein (2002) found no evidence of the long-run impact of U.S. bombing in World War II on Japanese cities' population.

<sup>4</sup>The former includes, for example, Fearon (1995), Fearon and Laitin (2003), and Collier and Hoeffler (1998). See Blattman and Miguel (2010) for more extensive review of the literature.

<sup>5</sup>This stream of literature originates to the poverty trap model by Azariadis and Drazen (1990), and is followed by many including World Bank (2003) and Sachs (2005).

give less. That is, reciprocity, not altruism, dominates the inter-household trade in this UXO-contaminated village.

Generalization of these findings in one small village to the entire Laos or even to Vietnam or other countries is impossible immediately, or may well be so essentially. Not only that each country has very different institutional history and background, each district received different intensity of bombardment for different tactical reasons. Our paper is just another small step in devouring the impact of Vietnam war, where one-by-one accumulation of the literature is the only way. Besides, as mentioned earlier, so far the literature is more in support of the “economic innocence” of post-war impact.<sup>6</sup> Though its findings are small, this paper is one of a few –if not the first– to provide an “inconvenient” evidence of the war’s long-run economic impact.

The remainder of the paper proceeds as follows. The next section briefly overviews the history and current situation of UXO contamination in the study area. Section 3 provides the description of our data as well as summary statistics of key variables. Section 4 presents the estimation models and their results of the UXO impacts on the inter-household trade. Finally, Section 5 concludes.

## 2 History and Situation of UXO Contamination in the Study Area

UXO in Laos is in essence one of the most enduring legacies of the Vietnam war. More than two million tons of explosive ordnance were dropped over the country by the US bombing missions between 1964 to 1973.<sup>7</sup> Up to 30% of all ordnance including those anti-personnel sub munitions released from cluster bombs are estimated to be remaining in the ground as UXO. To make it worse, some allied air forces who were asked by the U.S. to bomb Vietnam dropped the bombs in Lao instead without risking themselves by crossing the Lao-Vietnam border. U.S. in a quagmire apparently could not monitor –or at least effectively pretend to monitor– the action of its agents whoever they were. As a result Lao PDR became the most UXO-affected nation in the world.

In Laos, all 18 provinces are UXO contaminated. Among them, Luang Phrabang is one of the most severely contaminated provinces. It was once the old royal capital, and therefore was a base for Royalist forces during the conflict. Royalist forces fought against the Pathet Lao (PL) and the People’s Army of Vietnam (PAVN) when they tried to march down towards the south. After a brief victory the Royalist forces were forced out of the area and the PL forces occupied this territory until the end of the war. However, they were under repeated airstrikes by Royal Lao Air Force and Royal Thai Air Force.

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<sup>6</sup>It is never too clear to say here that war itself is not innocent, in front of the millions of lives lost during the Vietnam war and the pain and suffering that follow for generations.

<sup>7</sup>Grolier (1995) states that the power of the atomic bomb dropped at Hiroshima that killed 100 thousand people in one explosion is equivalent to up to 20 thousand tons of TNT, which is still a hundred times smaller than what Laos has received.

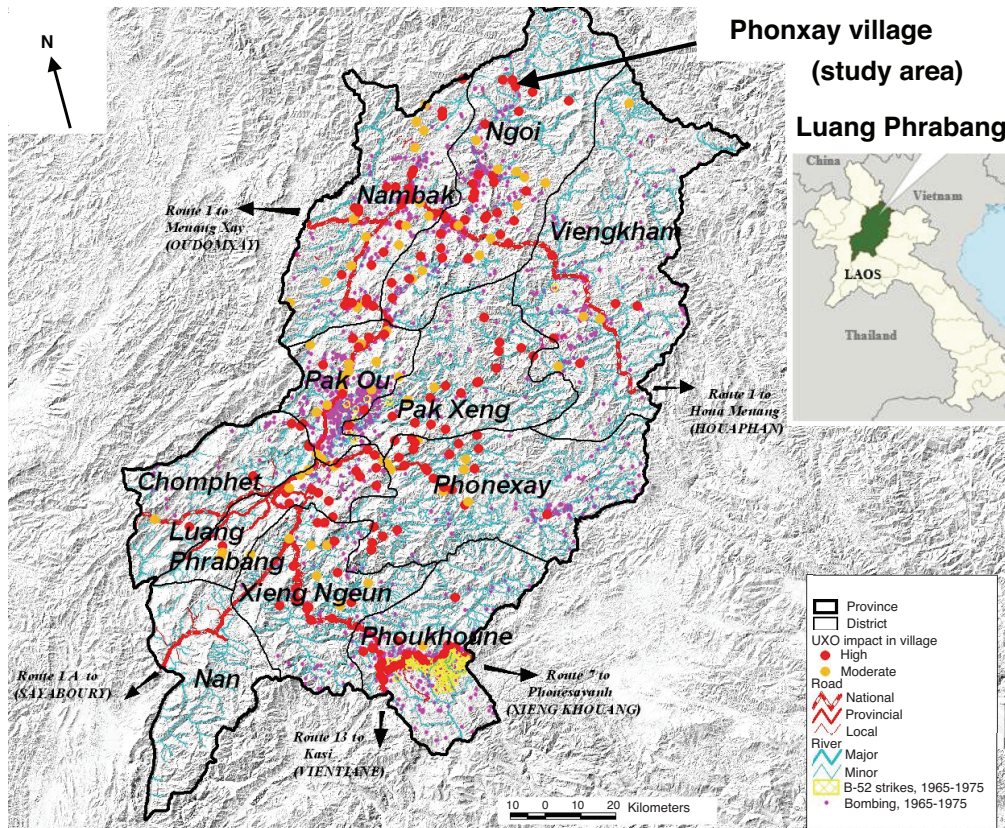


Figure 1: Luang Phrabang province and PhonXay village in Lao PDR

It is widely regarded that US conducted strategic bombing in the north e.g., Rolling Thunder campaign where they targeted infrastructure and other military facilities, and in the south they did interdiction bombing to deter enemy troops movement while supporting ground operations. Luang Phrabang, however, received both; in the early stage the region received the interdiction bombing against the PL and PAVN, and later it shifted its weight toward strategic bombing. As a result, this province became one of the most UXO-contaminated areas through the war.

Despite recent progress in reducing the number of victims, landmines and explosive remnants of war cause thousands of casualties annually, the most vulnerable in particular (Hagenlocher et al., 2016). Morikawa et al. (1998) showed, in their sample of rural Lao districts, that nearly half of the casualties are children below age 15. By 2012, 925 people were killed or injured due to UXO in Luang Phrabang province alone, and this figure is ranked fourth among 18 provinces in Laos.<sup>8</sup> About 25% of villages in Luang Phrabang province reports the existence of UXO, and Phonxay is one of them.

Phonxay village –as shown in Figure 1– is located in Ngoi district, a hilly mountainous area northeast of

<sup>8</sup>According to Lao National Unexploded Ordnance Programme Annual Report 2012.

Luang Phrabang province close to the border between Lao PDR and Vietnam. It is about 560 km<sup>2</sup> wide and is 70 km from the district center or 200 km from the provincial capital. According to the village's elderly, Phonxay –named after its founder– started 100 some years ago with a few families migrating from Ban Don, another village in the district, in search for land for rice cultivation. Since then, many followed for the same reason.<sup>9</sup>

As of 2016, total of 124 households are officially registered in the Phonxay village. The total population is 720, including 368 females. Now it is among the poorest villages in remote upland areas of Lao PDR. In Lao PDR, households with an income per capita below national poverty line at 180,000 Kip/month (or about 22.3 USD/month) are designated as poor. Out of 124 households in this village, 111 are below the line, of which 44 are categorized as the poorest with income being even below 50,000 Kip/month. Two UXO-affected households are classified as poor or poorest according to this categorization. Only 13 households are above the poverty line, and among these 13, four are considered as rich with per-capita income being more than 1,000,000 Kip, or about 124 USD/month. These four households are acting as rice merchants of the village, and many households sell and buy rice and other products to and from these four.

In the past, the area was a massive forest, and villagers were self-sufficient with various kinds of forest products and wild animals. During the 1970s, many households started producing and consuming opium, and their livelihoods seriously deteriorated. In early 2000s the Lao government took action to eliminate the opium poppy cultivation and villagers have transformed their income activities by growing more rice or other field crops, selling their livestock and non-timber forest products (NTFPs) by cultivating forest areas.

One household head in Phonxay village lost his left eye one afternoon in 2011, when the hoe that he was using to clear the grass from the family's rice field hit a cluster bomb. He told that he still remembered a small explosion, then a piece of shrapnel went into his eye. He was lucky that he was able to receive a first-aid treatment in the village hospital in time. Another household head was hit by a cluster bomb while he was trying to cut a tree in the family's rice field in 2009. He lost his lower right leg. Fortunately, he is now given the prosthetic leg.

### 3 Data

#### Sources and context of data

Traditionally, households in Phonxay village have been trading goods they produced among themselves. Some transactions involve cash payments while often they do not, and rather take the form of barter or more

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<sup>9</sup>At present, 95 percent of villagers are Animism. Phonxay village was officially set up in 1900.

implicit reciprocity system. Our dataset contains the amount of various locally-produced goods traded in either form, by each pair of households as outcome variables.

Our survey gathered data and information from all 124 households in the Phonxay village during February 29 and March 18, 2016. The data collection in this survey is done through direct, face-to-face interviews using a questionnaire. The survey employed five local government officials from Trade and Industry Office of Ngoi district, who are well-acquainted with the villagers. Questionnaire orientation for field staffs were carried out on February 20, 2016, just before the survey commenced.

For each household, along its demographic and economic characteristics, we surveyed the amount of eight locally-produced goods received from each of other households, with or without monetary compensations in the last 12 months. Our data thus contains the amount of trade between all directional pairs of households for each good.<sup>10</sup> With the total number of households being 124, our sample for each good is therefore consisted of 15,252 household pairs. In this paper, we hereafter call households who sell or donate products *donors*, and households who buy or receive products *recipients*. The surveyed goods are namely rice, cattle, goats, ducks, chickens, bamboos, brooms, and other non-timber forest products. Description of these goods are as follows.

**Rice** Rice, often referred to as upland rice, is the major crop grown after slash and burn. Vegetation is slashed in the month of February, allowed to dry during February to March and burned in April. Rice, mainly sticky rice, is the traditional and main food and income sources for Lao people including those in Phonxay. Rice is planted in hills from mid May to early June and harvested from late September to mid October. This rice is grown under rain fed conditions.

**Cattle** Indigenous cattle, yellow in color are reared for meat, although they were used for draught and transport in the past. In rural areas such as Phonxay, cattle are still raised predominantly by traditional methods and they are allowed to range freely for much of the time and feed themselves by grazing the natural grassland, in paddy fields after the harvest, on fallow land and in the forest. Meat products from cattle is exported to the urban and relatively high income areas of the country and Vietnam.

**Goats** Goats are found mainly in the mountainous and upland areas where there are more fodder trees, shrubs, bushes and grass and raised for meat. The native goats are small in size (birth weight of 2 kg and mature weight of 25-30 kg). Goats are raised and managed by individual households with little communal herding. They are housed at night in shelters of many different types of construction, usually with an earthen

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<sup>10</sup>These values are based on the local market prices, expressed in nominal terms at the time of survey.



floor. Lao people prefer eating the meat of goat.

**Ducks** Ducks are the second most important species of poultry next to chickens and include both the Muscovy (*Cairina moschata*) and the common duck (*Anas platyrhynchos*). Muscovy are mainly raised in mountainous areas because they are less dependent on water than the common duck which is found almost exclusively in the paddy areas. For rural smallholders, ducks are a vital source of protein and cash income, and a provider of inputs to crop production.

**Chickens** Chickens are one of the major species raised in rural Lao. Most are indigenous breeds and are mainly referred to as native chickens. Birds and eggs are for home consumption, but sold when cash is needed. Chickens not only provide food and cash income, but also inputs to crop production as well. Local chicken or native chickens have a live weight of 1-1.2 kg.

**Bamboos (Bamboo shoots)** Bamboo shoots are one of the main sources of villagers' diet as well as income during its season. Common bamboo species eaten for their shoots are *Gigantochloa albociliata*, *Bambusa arundinacea*, *Bambusa nana*, and *Bambusa tulda*. They are available during October to April in the community's bamboo forest, that is adjacent to the villagers houses. Part of harvests is sold to the local market and exported to China and Thailand.

**Brooms (Broom grass)** Brooms are made of grass called *Thysanolaena maxima* that grows naturally in the fallow forests in the area. Broom grass is one of the main non-timber forest products, collected for export to Thailand, and accounts for an major part of rural economy in the northern provinces of Laos. They are the key sources of income for most poor households in rural areas.

**Other non-timber forest products** Other non-timber forest products also contribute to their livelihood providing food, medicines, fodder, fuel, building materials and cash income. These include *Boehmeria malabarica*, a bark containing a gum which is used in China to produce glue and joss-sticks; Rattan shoots for housing needs such as cordage for making implements and roofing; and "Pong Peng" a kind of herbal roots used in China to make a medicine.

## **Summary statistics of the UXO-affected household characteristics and inter-household trade**

Table 1 shows the characteristics of UXO-affected households in comparison to other households. Their total

Table 1: Characteristics of UXO-affected households in comparison to other households.

	Average of UXO-affected households	Difference from other households	95% Interval of the difference
Consumption of non-durables	6,076	-484	[-10,909, 3,515]
Consumption of durables	588	-790	[-7,817, 362]
Total consumption	6,691	-1,597	[-19,746, 4,085]
Household size	5.50	-0.31	[-2.580, 1.957]
Land size	1.50	0.24	[-0.903, 1.132]
Gender of household head (male=1)	1.00	0.14	[-0.349, 0.628]
Education level of household head	8.00	1.36	[-2.557, 5.278]
Age of household head	47.0	-2.0	[-19.53, 15.53]

*Notes:* The number of UXO-affected households is two and there are 122 other households. As for consumption, averages are geometric means for both UXO-affected and other households and 95% intervals of the difference are computed based on log values then converted back to the measure of 1,000 Kip. Gender of household head is one for male and zero for female. Education is in years.

consumption on average is 6.7 million Kip or about 800 USD per year, which is 1.6 million Kip (or 200 USD) smaller than other households.<sup>11</sup> Consumption as well as other variables such as household size, land ownership, and gender, education, and age of the head are deemed not different from that of others. On one hand this justifies that the UXO-affected households are no different from others.

On the other hand however, it is due to that the number of UXO-affected households is only two in this simple comparison of households, and therefore that the confidence interval of the difference is wide. This small sample size implies low power, and it is apparently hard to derive any empirical result. Our data allows us to go around this issue by looking at each *pair* of households rather than a household itself as a unit of analysis. Our analysis below therefore focuses on the inter-household trade between the directional pairs of households.

Table 2 presents the average pairwise values of goods traded to and from UXO-affected households and among others, as well as their differences. Column (i) in the table shows average amount of goods received by UXO-affected households from each of others, and column (ii) shows the average amount of goods received by other households. The differences between columns (i) and (ii) are in the third column. Similarly, column (iv) presents average amount of goods donated by UXO-affected households to other households. In column (v) are the average amount of goods donated by other households. Lastly, column (vi) gives the difference between the columns (iv) and (v).

Here we see that, though many are insignificant, significant coefficients are all negative. Trade values of UXO-affected households both as recipients and donors are never greater than that of other households.

<sup>11</sup>These averages are geometric means, as the distribution of consumption is highly skewed to the right.

Table 2: Average values of goods traded to and from UXO-affected households and other households, and their differences.

<i>Traded good</i>	(i) UXO affected households as recipients	(ii) Other households as recipients	(iii) <i>difference</i> ((i) - (ii))	(iv) UXO affected households as donors	(v) Other households as donors	(vi) <i>difference</i> ((iv) - (v))
Rice	22.154 (113.241)	41.571 (191.366)	-19.417 [12.2363]	20.325 (134.822)	41.601 (191.134)	-21.276 * [12.2361]
Cattle	0.000 (0.000)	5.993 (144.803)	-5.993 [9.2326]	0.000 (0.000)	5.993 (144.803)	-5.993 [9.2326]
Goats	2.439 (26.995)	7.467 (111.226)	-5.028 [7.0952]	0.000 (0.000)	7.507 (111.277)	-7.507 [7.0950]
Ducks	1.646 (13.242)	1.274 (13.889)	0.372 [0.8921]	0.894 (9.939)	1.287 (13.934)	-0.393 [0.8921]
Chickens	2.256 (15.814)	2.976 (23.280)	-0.720 [1.4899]	0.447 (7.013)	3.006 (23.348)	-2.559 * [1.4898]
Bamboos	0.093 (1.466)	3.146 (22.709)	-3.052 ** [1.4480]	3.862 (26.698)	3.084 (22.455)	0.778 [1.4482]
Brooms	0.000 (0.000)	4.786 (40.823)	-4.786 * [2.6028]	5.122 (38.816)	4.702 (40.525)	0.419 [2.6031]
Other non-timber forest products	1.016 (11.472)	3.072 (25.773)	-2.056 [1.6459]	3.252 (27.285)	3.035 (25.579)	0.217 [1.6460]
<i>No. of Obs.</i>	246	15,006		246	15,006	

*Notes:* All values are in thousand Lao Kip or about one eighth of a USD. Standard deviations are in parentheses. Standard errors are in square brackets. Significance at 10% is indicated with \* and 5% is with \*\*.

This suggests that UXO-affected households are averagely in isolated situation in the transactions within the village.

Specifically, receipt of bamboos (and brooms, though weakly) is significantly lower than that of other households. Bamboos and brooms are supplied not only by UXO-affected households but also by other households. However, UXO-affected households receive very little of them; producing brooms and bamboo products are one of a few ways of making living for the disabled.

Being disabled, raising livestock in general is difficult, too. UXO-affected households receive chickens just as others, yet, they do not seem to give much of them to others. This could be true for larger livestock, however, its trade is too lumpy to generate significant difference in the simple averages. For example, average value of cattle trade is 4,612 thousand Kip or over 500 USD, and among the 15,252 pairs only 39 made transactions of cattle during the observation year, where transactions involving UXO-affected households are not included.

Donation amount of rice is weakly significantly smaller for UXO-affected households. One potential reason may be that their production is smaller than the others due to household characteristics. Another is that four rice merchants are acting as “hubs” in the rice trade. To control these factors, we run in the next section reduced form regressions by including household characteristics such as land size and consumption as well as a dummy for rice merchants.

The above results of simple comparison of averages identify the negative impact of UXO damage to some extent, however, it is not free from household specific effects especially the number of UXO-affected households is just two. In the next section, we therefore eliminate these household-specific effects by incorporating household-fixed effects in the reduced form estimation and controlling other household characteristics.

## 4 Estimation of the UXO Impacts on the Inter-Household Trade

As mentioned above, a unit of analysis in our estimation is a directional pair of households, one being the donor and another being the recipient of the trade. Among those 15,252 household pairs, 490 are either from or to the UXO-affected households, and the rest are between other households. That is, there are 246 household pairs when UXO-affected households are recipients and donors respectively. We define each of these two cases as a separate treatment group and let the remaining 15,006 pairs as a control group.

Our outcome variable is values of each good traded between these directional pairs of households. Traded values of each good are taken log to consist a dependent variable of the regression in all models. We take log of traded values after adding one Kip to all units of observation.

## Empirical models

We specify two different models for each of the two treatment cases above, namely, a case with UXO-affected households being recipients and another they being donors. Given that there are only two UXO-affected households in the sample, to eliminate household-specific effects in each treatment case either recipient-household fixed effect or donor-household fixed effect is incorporated in all models.

The first model, say Model 1, is a fixed-effect regression without covariates. We run this model for both cases of UXO-affected households being recipients and donors as follows:

$$\begin{aligned} y_{ijk} &= \alpha_k^R + \beta_k^R x_i + \epsilon_j + \varepsilon_{ijk}^R \\ y_{ijk} &= \alpha_k^D + \beta_k^D x_j + \phi_i + \varepsilon_{ijk}^D \end{aligned} \quad (1)$$

for all  $i \neq j \in \{1, \dots, 124\}$  and  $k \in K$ , where  $K$  is the set of all kinds of commodities traded,  $y_{ijk}$  is the amount of good  $k$  traded from household  $j$  to household  $i$ ,  $x_i$  is the dummy that the household  $i$  is UXO-affected (and similar is for  $x_j$ ),  $\epsilon_j$  and  $\phi_i$  are donor- and recipient- household fixed effects,  $\varepsilon_{ijk}^R$  and  $\varepsilon_{ijk}^D$  are error terms, and superscripts  $R$  and  $D$  represent recipient and donor, respectively.

The second model that we refer to as Model 2 includes, along with household fixed effects and a dummy if the household is UXO-affected, other household characteristics namely, its size, land ownership in terms of area, consumption of durable and nondurable goods, head's age, gender and education level, and a dummy if it is one of four rice merchants, as covariates. It is therefore expressed as

$$\begin{aligned} y_{ijk} &= \alpha_k^R + \beta_k^R \mathbf{x}_i + \epsilon_j + \varepsilon_{ijk}^R \\ y_{ijk} &= \alpha_k^D + \beta_k^D \mathbf{x}_j + \phi_i + \varepsilon_{ijk}^D \end{aligned} \quad (2)$$

where  $\mathbf{x}_i$  ( $\mathbf{x}_j$ ) is the recipient (donor) household characteristics vector including the UXO dummy and covariates. That is to say, when the treatment is UXO-affected households being the recipients, it includes donor-household fixed effects and the characteristics of the recipient households.<sup>12</sup> Conversely, when the treatment is UXO-affected households being the donors, household fixed effects are the dummies for the recipient households and the covariates are the characteristics of the donor households.

## Estimation results

Table 3 shows the estimation results of the impact of a UXO-affected household being the recipient or the

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<sup>12</sup>Also, clustered standard errors are used along with the household fixed effects.

Table 3: Effects of UXO-affected households being recipients and donors on the inter-household trade.

<i>Traded good</i>	Recipient is UXO affected		Donner is UXO affected	
	(vii) Model 1	(viii) Model 2	(ix) Model 1	(x) Model 2
Rice	-0.0939 [0.125]	0.167 [0.116]	-0.385 *** [0.0651]	-0.116 [0.0759]
Cattle	-0.0369 ** [0.0154]	-0.0194 ** [0.0082]	-0.0369 *** [0.0080]	-0.0291 *** [0.0097]
Goats	-0.0048 [0.0464]	0.0609 [0.0699]	-0.108 *** [0.0130]	-0.0829 *** [0.0141]
Ducks	0.0741 [0.0839]	0.0504 [0.0825]	-0.0191 [0.0674]	0.0065 [0.0661]
Chickens	0.0058 [0.0679]	0.0072 [0.0655]	-0.184 *** [0.0492]	-0.112 ** [0.0505]
Bamboos	-0.259 *** [0.0431]	-0.172 *** [0.0449]	-0.0077 [0.0894]	-0.0375 [0.0883]
Brooms	-0.234 *** [0.0096]	-0.0336 ** [0.0138]	0.0192 [0.0983]	-0.0304 [0.110]
Other non-timber forest products	-0.126 * [0.0674]	-0.0265 [0.0659]	-0.023 [0.0581]	-0.0865 [0.0693]
Household fixed effects	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes
Household fixed effects	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes

*Notes:* Robust standard errors are in square brackets. Value of trade is taken log after adding one Kip to conform the dependent variable. Donor (recipient) household fixed effects are used in the model with UXO-affected households being recipients (donors), along with clustered standard errors that are grouped by donor (recipient) households. Controls in Model 2 are household size, household's land ownership (area), household head's age, gender, and education level, a dummy if the household is one of those four rich ones, and consumption of durable and nondurable goods (after adding one Kip and taking log), for donors and recipients respectively. Sample size is 15,252 for all models. Significance at 1% is indicated with \*\*\*, 5% is with \*\*, and 10% is with \*.

donor on the trade of goods, relative to those trade between other households. The first two columns, (vii) and (viii) give the impact of the UXO victim being the recipient on the values of goods traded in the community. The last two columns, (ix) and (x) present the impact of the UXO victim being the donor in the traded values of the listed goods. First of all, the impacts are never positive for all goods in both cases just as the simple average comparison in Section 3. It turns out again that, being UXO victims, they do not receive or give any good more than others. What is to be noted here is that the results are now stronger; the impact is negative more significantly, for more variety of goods (the only exception being rice in Model 2 when UXO-affected households are the donors). Consequently, we conclude that the UXO-affected households are segregated from the trade of goods in the community both as recipient or donor, or simply put, they are ostracized.

For the case of UXO-affected households being the recipient, coefficient for rice is again insignificant. When the UXO-affected households are the donors, rice coefficient is still negative even after controlling for the recipient-household fixed effects. However, controlling the donor-households' characteristics in Model 2 makes it insignificant. This result indicates that, putting aside the four households that are acting as rice merchants, UXO-affected households are trading rice just as others.

After controlling for the household characteristics and fixed effects, a range of livestock trade is revealed to be significantly smaller for UXO-affected households. They do not produce as much cattle, goats, and chicken so as to give to others. As for cattle, its trade is rather lumpy and rare. In fact there were no transactions involving UXO-affected households for cattle during the observation year. A similar argument applies to the case of goat trade when the UXO-affected household being the donor. These were potentially the reason behind the weak (insignificant) negative result in the comparison of averages in the previous section. Here, the results are negative with significance, indicating their incapacity of raising larger livestock. Not only the trade of larger livestock, but chicken trade from UXO families to others is strictly smaller relative to those among others, now at 5% significance level. UXO-affected households' incapacity of raising livestock seems to apply to smaller livestock as well.

So, they do not give any good more than others. At the same time, they receive those livestock such as goats and chickens as well as rice just as much as others. They seem to make ends meet by receiving less of bamboos and brooms. Receipt of bamboos and brooms now turned out to be significantly smaller with more significance, at 1% and 5% respectively. While they give bamboos and brooms just as others, they do not receive them much. This shows that they are making their humble living out of their only means: providing bamboos and brooms to others.

## Are they discriminated, or just ostracized?

The results above show that UXO-affected households receive and give any goods never more than others. This ostracization of UXO-affected households, however, can be the result of the reciprocity system that is apparently dominant in this village. That is, they receive less, simply because they give less. Here in this section we investigate if they receive more or less than what they should in return for what they give, and vice versa. If the community is helping the UXO-affected households, they receive more than what they deserve. If the community is discriminating them, then they receive less.

The following models explicitly consider that the amount of goods household  $i$  receives from  $j$  depends not only on household characteristics including whether the household is UXO-affected, but on the amount of goods that the household  $i$  gives to  $j$ :

$$\begin{aligned} y_{ijk} &= \alpha_k^R + \beta_k^R \mathbf{x}_i + \gamma_k^R \mathbf{y}_{ji} + \epsilon_j + \varepsilon_{ijk}^R \\ y_{ijk} &= \alpha_k^D + \beta_k^D \mathbf{x}_j + \gamma_k^D \mathbf{y}_{ji} + \phi_i + \varepsilon_{ijk}^D \end{aligned} \quad (3)$$

for all  $i \neq j \in \{1, \dots, 124\}$  and  $k \in K$  where  $\gamma_k^R$  or  $\gamma_k^D$  is a  $K$ -vector of coefficients and  $\mathbf{y}_{ji}$  is another  $K$ -vector containing the values of all kinds of goods traded from household  $j$  to  $i$ . Household characteristics vector  $\mathbf{x}_i$  and  $\mathbf{x}_j$  includes all covariates just as in (2).<sup>13</sup> We expect the coefficient to the UXO recipient dummy to be positive, if community is altruistic to UXO families so that they receive more than what is explained by reciprocity. If in turn it is negative, we can view that they are rather discriminated. Similarly, if the coefficient to the UXO donor dummy is negative, the community is altruistic in that they tolerate UXO-affected households to be giving less than what the reciprocity requires in return for what they receive.

Table 4 summarizes the estimates of the elements in the coefficient vectors  $\beta_k^R$  and  $\beta_k^D$  pertaining to the UXO-household dummies. Column (xi) presents the impact of the UXO victim being the recipient on the values of each goods traded in the community after controlling the amount of all goods that he gives to others. Column (xii) presents the impact of the UXO victim being the donor in the traded values of the listed goods, after controlling the amount of the all goods that they receive from others. Estimated coefficients are neither positive or negative for all goods in both models. These results imply therefore that the community neither helps or discriminates the UXO families; they receive as much as they give, and they give as necessary as they receive, just as the same as others. Their ostracization that we found in the previous section is therefore, a bitter cold result of strict reciprocity that is dominant in this poor remote village.

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<sup>13</sup>Because of the simultaneity, we apply three-stage least squares to each of the above two models.



Table 4: 3SLS Estimation results of the coefficients of UXO dummies.

<i>Traded good</i>	(xi) Recipient is UXO affected		(xii) Donor is UXO affected	
Rice	0.1782	[-0.1356, 0.4921]	0.0100	[-0.2790, 0.2990]
Cattle	-0.0013	[-0.0951, 0.0924]	-0.0076	[-0.1125, 0.0972]
Goats	0.0345	[-0.1208, 0.1897]	-0.0655	[-0.2694, 0.1384]
Ducks	0.0571	[-0.0988, 0.2130]	-0.0303	[-0.2456, 0.1850]
Chickens	0.0522	[-0.1560, 0.2604]	-0.1482	[-0.4900, 0.1937]
Bamboos	-0.1096	[-0.3722, 0.1530]	-0.0278	[-0.2460, 0.1904]
Brooms	0.0305	[-0.1979, 0.2590]	-0.0094	[-0.1712, 0.1524]
Other non-timber forest products	0.0305	[-0.2565, 0.3176]	-0.0908	[-0.2612, 0.0797]

*Notes:* 95% confidence intervals are in square brackets. Values of trade are taken log after adding one Kip to conform the dependent variable. Donor (recipient) household fixed effects are used in the equations with UXO-affected households being recipients (donors), along with recipient (donor) household's characteristics such as size, land ownership (area), consumption of durable and nondurable goods (after adding one Kip and taking log), head's age, gender and education, and a dummy if the household is one of the four rich ones. Sample size is 15,252 for each equation.

## 5 Conclusions

Lao PDR is recognized as the most severely contaminated nation by unexploded ordnance (UXO) from the Vietnam war. Casualties amount to over 50 thousand and are still increasing, and survivors suffer serious disability. Recently, two villagers are seriously injured and disabled by UXO in a village called Phonxay in northern Lao near the Vietnam border. While many study points out the correlation between regional poverty and the explosive remnants of war, their causal relationship is yet to be identified. In devouring the causation between the heritage of Vietnam war and the affected people's livelihood and wellbeing, this short paper identified a negative causation between UXO impacts and intra-village inter-household trade of locally produced products by using primary data obtained in this UXO-contaminated remote village. The paper found that the UXO-affected households give and receive significantly smaller amount of locally-produced commodities to/from others. The paper also finds that in this poor village a reciprocity system is dominant, suggesting that it is difficult to expect autonomous cooperation and support for those disabled villagers from others. As a result, UXO-disabled households are economically ostracized.

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