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The Human Capital Cost of Landmine Contamination in Cambodia

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Abstract: The International Campaign to Ban Landmines production and use estimates that there are more than 80 billion landmines in the ground in more than 80 countries. Despite the scale of the problem and large investments by OECD countries to clear mines in low income countries, the economic consequences of landmine contamination have been so far unexamined by economists working on the economics of wars, perhaps due to the lack of data thus far. Using unique data from Cambodia, this paper estimates the effect of landmine contamination on human capital. These effects are identified using difference-in-differences (DD) and instrumental variables (IV) estimators. In the DD framework I exploit two sources of variation in an individual's exposure to the conflict: her age in 1970 due to the spread of landmines over time and landmine contamination intensity in her district of birth. The IV specification uses the distance to the Thai border as an exogenous source of variation in landmine contamination intensity. The IV estimate indicates a education loss of 0.4 years at the mean and no visible effect on earnings. I discuss three factors that probably drive down the returns to education in post-war Cambodia: (1) The downgrading of educated people during the Khmer rouge regime (2) Direct Effects of landmines on the returns to education (3) the destruction of physical capital and technological delay through capital-skill complementarity.

Keywords: war, land mines, education, earnings, returns to education, difference-in-differences estimator, instrumental variables
JEL Codes: O1, O55

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1 Introduction

The International Campaign to Ban Land mines production and use estimates that there are more than 80 billion land mines in the ground in more than 80 countries.

Land mines are one of the most widely used weapons in contemporary conflicts because they are cheap to buy and profitable to sell. Despite the growing awareness within the international community that what has come to be known as the "global land mine crisis" has far-reaching consequences on development, effort to clear land mines is taking place in only 34 countries. A major factor explaining such under-investment in land mine clearance is probably the cost: while a land mine costs about 3 dollars to produce, according to the UN mine action program, it costs between 300 to 1000 dollars to clear a mine. As a consequence policymakers in land mined countries often argue that investing in land mine clearance cannot yield a positive return. This may be the case because land mines remain active for a limited time varying between 25 to 50 years. Most landmine clearance programs are financed by OECD countries through bilateral or multilateral assistance. Land mine clearance assistance has followed a steady upward trend during the last ten years with a rapid acceleration started in 1999 with the signature by hundreds of countries of a Treaty to Ban Land mine Use and Production. The European Community (EC) assistance amounted to 42 million Euro in 2002, a 48 per cent increase relative to the previous year. The US remains the largest aid donor with about 80 million USD allocated to 37 countries worldwide. Between 1993 and 2002 the US invested 560 million USD in mine action assistance of all forms: demining, technical assistance, mine action education and so on so forth (Source: Landmine Monitor Report issues 1999 to 2003). Both the US and EC mine action programs expect to include an increasing number of countries in the coming years. In 2002, the top recipients were Afghanistan ($ 64.4 million); Iraq ($30.6 million) ; Cambodia ($ 27.3

million) and Mozambique ($ 18 million). For Afghanistan demining assistance from the EC and US represents about 15 per cent of total Overseas Development Assistance funds received. Despite growing donors assistance to clear land mines there is scant empirical evidence on the economic impact of land mine contamination. This paper is a first attempt to fill this gap. Cambodia offers an ideal setting for this study for several reasons. First of all, measures of land mine contamination were readily available at district level with an administration divided into about 185 districts. Second, following about thirty years of war (1970-1998), Cambodia is today one of the most heavily land mine contaminated countries in the World with about one mine planted for each inhabitant and is also a top aid recipient. Third, although conflict in Cambodia ended in 1998, because it lasted about 30 years it is already possible to evaluate for a cohort of individuals born from 1950-1970 the impact of land mine contamination on education levels and subsequent labor market consequences.

The empirical strategy uses the fact that exposure to land mines varied by district of residence and date of birth. I use a difference in differences (DD) estimator that controls for systematic variation of education both across districts and across cohorts. If land mines cause a serious education setback, the education of individuals who had more of their primary education years exposed to land mine contamination damages (due to the spread of land mines over time) should be lower than the education of older individuals in all districts, but this difference should be higher in districts where land mine contamination is more intense. Similar strategies have been used to evaluate the effects of public policies (Duflo (2001) and Pitt et al (1993)). Further, for totally exogenous reasons, land mine contamination is much more severe along the Thai border. Hence I also report instrumental variables (IV) estimates using the distance to the Thai border as an instrument for land mine contamination. IV allows to correct for possible bias in DD estimates due to confounding factors or mean reversion.

The effect of land mine contamination on education is large in magnitude and indicates that at the mean level of exposure, land mines cause a 0.4 years fall in education. However, I find no evidence that this resulted in lower earnings. I test several hypothesis for why this may be the case including the possibility that land mines have a direct effect on the returns to education through adverse effects on workers' health.

This paper is related to a rapidly growing literature on the economic consequences of war in developing countries. Miguel and Roland (2005) evaluate the long term economic impact of US bombing in Vietnam. They do not find a robust negative impact of U.S. bombing on poverty rates, consumption levels, infrastructure, literacy or population density through 2002. One explanation they provide for this result is that provinces that were more heavily bombed during the war received somewhat greater postwar state investments. Two other papers have exploited *war experiments* to estimate returns to education in developed countries by simply comparing education levels of *war* and *non-war* cohorts. Ichino and Winter-Ebmer (2002) evaluate the long run educational cost of World War II. Their findings indicate that Austrian and German individuals who were ten years old during or immediately after the conflict received less education than individuals in other cohorts. The fact that the only available source of variation in exposure to war is the individuals age during the war makes it difficult to rule out the possibility that their results are plagued by confounding factors and omitted variables. Maurin and McNally (2006) exploit a much briefer event, the french student riots of 1968, which makes their analysis more convincing since they are able to compare three different cohorts with only one year age difference. However, their focus is on returns to higher education in a developed country while the focus of this paper is on the returns to compulsory education in a developing country. The lower level of human, physical capital and technological advancement in developing countries may cause returns to education (i.e. earnings inequality) to be significantly different and probably lower than estimates available for developed countries.

The remainder of the paper is organized as follows. In section I, I provide a brief historical background on the war in Cambodia. In section II introduces the data. Section III develops a simple conceptual framework. Section IV describes the identification strategy. Section V, discusses the results. Section VI concludes the paper.

2 War and Land mine Use and Distribution in Cambodia[1]

The Cambodian people have experienced war almost continuously for the past 30 years. These years can be roughly divided into five phases: a civil war from1970–1975; the rule

[1] This section heavily relies on http://www.mekong.net/cambodia/mines.htm and http://www.seasite.niu.edu/khmer/Ledgerwood/Landmines.htm

of the Khmer Rouge from 1975–1979; the Vietnamese invasion and occupation from 1979–1989; continuing but relatively light civil war from 1989–1993; and infighting among competing political factions from 1993 to 1998. Taken together, these wars, conflicts and political campaigns have claimed no fewer than 2.5 million lives and devastated the country's infrastructure and human capital.

French control of Cambodia began in 1864 and developed as an adjunct to French colonial intents in Vietnam and Laos. After the Second World War Cambodia became an autonomous state within 'the French Union'. During this period various political groupings became prominent. Aided by the fact that the Franco-Viet Minh war was raging in Vietnam and Laos, King Sihanouk managed to obtain Cambodian Independence in 1953. Sihanouk then dominated Cambodian politics for 15 years, until General Lon Nol deposed him as chief of state. The Khmer Rouge, led by the French educated Pol Pot (formerly Saloth Sar), played a major role in attempting to overthrow the Lon Nol regime. Despite enormous military and economic aid from the US, Lon Nol was unsuccessful in preventing the Khmer Rouge from over taking Phnom Penh and Cambodia. The next three years, after the take over in April 1975, saw possibly the most radical of all social revolutions ever enforced. During this time at least two million people died from illness, starvation or directly at the hands of fellow Khmers. However, in late 1978, Vietnamese intervention, following a series of border clashes, led to the Khmer Rouge retreating to the Thai bordered North-West region of Cambodia. The Vietnamese installed a new government led by Hun Sen, a former Khmer Rouge officer who had defected to Vietnam in 1977.

Following thirty years of conflict, Cambodia is today one of the most heavily land mined countries (among 80 countries Worldwide) with about six million landmines for ten million inhabitants. Landmines may remain active for up to fifty years and therefore may be considered a serious threat to long-term development and post-war recovery. They adversely affect agricultural development, human capital development and often block access to public infrastructure (roads, schools, power line, water plants, dams). It is generally accepted that more than 40,000 Cambodians have suffered amputations as a result of mine injuries since 1979. That represents an average of nearly forty victims a week for a period of twenty years. In Cambodia there is a substantial variation across districts in the extent of land mine contamination (see map). The majority of the land mines are to be found in the Krong Pailin, Battambang, Pursat, Banteay Mean Chey and the Preah Vihear provinces (all in the North and Western regions). Unlike other weapons, mines were extensively deployed around borders by all groups as a weapon of choice to protect territory[2]. While in power from 1975 to 1979, the Khmer Rouge used mines extensively along the borders with Vietnam and Thailand, turning the country into what was called a "prison without walls". **Starting in 1985, millions of mines were laid in a 600-kilometer long and 800-kilometers wide K5 barrier along the Thai border under the notorious K5 conscription program. The K5 (kor pram) barrier was an extensive defence barrier of mines, anti-tank ditches**

[2] Battlefield UXO are found countrywide, and aerial delivered ordnance are found mainly in the eastern and central provinces (US Department of State, 1998:66, Hidden Killers). Also see http://www.yale.edu/cgp/ for details on Khmer Rouge genocide distribution across the country

and bamboo fencing, constructed in the north-west by the Vietnamese who invaded Cambodia to put an end to the Khmer rouge regime. The K5 barrier was intended to act as a barrier against the retreating Khmer Rouge forces. On the other side of the border, Thai military forces laid extensive defensive minefields to prevent infiltration by Vietnamese troops. Minefield location maps were generally not drawn.

3 Data

The 1997 Cambodia socioeconomic survey is a sample of 6,000 households. I focus on the sub-sample of individuals born between 1950 and 1970. Hence, all individuals in the sample have completed school in 1997. Summary statistics are reported in Table 1. There are 6703 individuals in the sample with an average level of 4.34 years of education. The survey reports yearly average monthly earnings. Given the earning sample is small relative to the education sample I use last month earnings also reported in the survey when yearly average monthly earnings are not reported. This allows me to increase the earning sample from 1852 to 3252 observations. In order to address issues of migration selection I use each the individuals district of birth (rather than the current district of residence) to match the survey data with the district level measure of war intensity i.e. the proportion of a district surface contaminated by land mines. This measure is reported in the Cambodia national level 1 survey (NL1S) provided by the Cambodia Mine Action Center (CMAC) and completed in 2002. Landmine contamination is measured with some error in part due to the difficulty to identify areas contaminated in remote places that were not accessible to the surveyors. Another less obvious source of measurement error is landmine clearance. Between 1992 and 1998 about 148 square kilometers of land were cleared (Land mine Monitor Report, 1999). Measurement error leads to an attenuation of OLS estimates. However, according to NL1S about 4400 square kilometers remained to be cleared in 2002. Endogenous land mine clearance is therefore not a serious concern.

4 Conceptual Framework

The potential impact of land mine contamination on human capital can be described using a simple model of endogenous schooling developed in Card (1995) and Duflo (2000) who build on Becker (1967). I assume individuals belong to two cohorts denoted c and 0. Individuals in cohort 0 are assumed to have completed school at the start of the war so their educational choice were not exposed to war damages. An individual's utility is $U(y, E) = y - C(E)$, where y denotes the logarithm of the individual wage w with $\ln w = f(E)$. I write the marginal cost of schooling function $C'(E)$ as a linear function of the number of years of education E

$$C'(E) = r_{dc} + \lambda E \quad (1)$$

The optimal level of education is derived by maximizing individuals utility which gives:

$$S_{idc} = \frac{f'(E) - r_{dc}}{\lambda} \tag{2}$$

The cost of education for cohort c living in district d can be written as a linear function of the overall public investment into education denoted I_{dc}.

$$r_{dc} = \alpha_1 I_{dc} \tag{3}$$

I_{dc} may include the number of schools, infrastructure that ameliorate school access (roads, transportation), public spending into teacher salaries, school furniture, agricultural land (as a source of income) and so on so forth.

One can then compute the average education level for the exposed and non-exposed cohorts in a given district and obtain the difference between these two averages which can be written linearly as:

$$S_{dc} - S_{d0} = \pi_0 + \pi_1 \left(I_{dc} - I_{d0}\right) + \varepsilon_d \tag{4}$$

This equation is obtained assuming returns to education are similar across cohorts within district. Another assumption is that the generations not exposed to the war did not anticipate it when choosing the educational level.

Land mine contamination affects the level of education of the exposed cohort by increasing the cost of education through its negative impact on I. The variation in I between the two cohorts in a given district is a function of the intensity of land mine contamination in that district. Land mine contamination intensity will be measured by the fraction of land contaminated in a district, LC_d. Hence, I can rewrite equation (4) as:

$$S_{dc} - S_{d0} = \pi_0 + \pi_1' LC_d + \varepsilon_d' \qquad (5)$$

The statistical approach will be to estimate this equation. A similar equation can be derived for the difference in the average wage across cohorts assuming earnings are a linear function of educational levels. This simple model may be extended further as in Duflo (2001) to incorporate the potential direct effect of land mine contamination on the returns to education. This possibility will be investigated in the empirical analysis.

5 Identification Strategy

Two sources of variation in an individual's exposure to the damages caused by land mines are exploited within a difference-in-differences framework.: (1) The number of years an individual school choice is exposed to conflict; and (2) the intensity of land mine contamination is her district of birth. Since the sample average number of years of education is 4.6 years, the analysis focuses on the primary education years. Since in Cambodia children attend primary school between 6 and 12 years of age, the first source of variation is defined as the number of years an individual is exposed to conflict between 6 and 12 years of age. This will yield results that are to be taken as conservative because, for instance, the education of an individual aged 12 in 1970 is assumed to be unaffected whereas she has not completed secondary school.

The corresponding difference-in-differences specification reads as follows:

$$y_{idk} = c_1 + (N_i * LC_d)\,\gamma_1 + \beta_{1k} + \alpha_{1d} + \varepsilon_{idk} \tag{6}$$

where y_{idk} is the outcome of interest (i.e. the number of years of completed education or the logarithm of earnings), N_i is individual $i's$ number of primary school years *exposed* to the conflict, c_1 is a constant, β_{1k} is a cohort of birth fixed effect, α_{1d} is a district of residence fixed effect, LC_d is the proportion of district $d's$ surface contaminated by land mines, and ε_{idk} an error term. Clustered standard deviations at the district level will be reported.

This approach does not allow to capture Cambodia-wide effects of landmine contamination which would require using country-level data with the quasi-insurmountable empirical challenges it would imply. Further, using the strategy summarized in equation (6) is valid if there are no other time-varying and region specific effects correlated with the war (and not directly caused by the war). This assumption may fail to hold true. For instance, the level of poverty in a district probably determines the level of investment in human capital and may be also correlated with land mine contamination. In order to address this problem and also correct for other potential confounding factors and mean reversion, I will also use an instrumental variables (IV) estimator.

The IV strategy uses the fact that unlike other weapons and war related damages[3]

[3] It is important for the validity of the exclusion restriction to emphasize that the closeness to a border determines the use of landmines but not that of other weapons. In addition, if the intensive

land mines were extensively and disproportionately led along the Thai-Cambodian border as a weapon of choice to protect territories and this due to exogenous events. Indeed, as already described in details in section 2, the massive distribution of land mines along this border is unrelated to its level of economic development or any factor that may determine school choices or investment in human capital. Instead, land mines were led massively in this region following the Vietnamese occupation only as a military response to impede the infiltration of retreated Khmer rouge opponents.

In other words, proximity to the Thai border can be used as an exogenous source of variation in land mine contamination intensity. The survey asks to each household head her level of fluency in Thai and other languages. From this, I compute the average district fluency in Thai and the average district fluency in Laosian and Vietnamese which I use to control for any confounding endogenous factors associated with the proximity to a border or endogenous sorting of immigrants into regions. The underlying assumption is that these effects work in a similar way along all borders. The Two-Stage-Least-Squares (TSLS) specification reads as follows:

First stage

$$(N_i * LC_d) = c_2 + (N_i * Thai_d)\,\gamma_2 + (N_i * Laosian_d)\,\varphi_2 + (N_i * Vietnamese_d)\,\theta_2 + \quad (7)$$

$$\beta_{2k} + \alpha_{2d} + \upsilon_{idk} \quad (8)$$

where $Thai_d$, $Laosian_d$, $Vietnamese_d$ are respectively the average population fluency in each language in individual i's district of residence. $N_i * Thai_d$ is the excluded

use of landmines along borders caused a displacement of other war damages to other areas this will have the effect of attenuating the estimated impact of landmine contamination.

instrument in the second stage which reads:

Second stage

$$y_{idk} = c_3 + \left(\widehat{N_i * LC_d}\right)\gamma_3 + (N_i * Laosian_d)\,\varphi_3 + (N_i * Vietnamese_d)\,\theta_3 + \beta_{3k} + \alpha_{3d} + \zeta_{idk} \tag{9}$$

where $\widehat{N_i * LC_d}$ is the predicted value of $N_i * LC_d$ obtained from the first stage.

Table 2 reports first stage estimates for the whole sample and the earning sample. As is clear from the table, the instrument is a very good predicator for land mine contamination intensity. Note that the indicator of language fluency can take value 1 for *fluent in Thai* to 5 for *no knowledge of Thai*. Hence, the coefficients have the expected sign: exposure to land mine contamination is higher in districts in close proximity to the Thai border and lower in districts distant from the Thai border.

6 Results

Table 3 columns 1 and 3 report OLS and IV estimates of the average impact of land mine contamination on the number of years of education. Both OLS and IV estimates confirm that land mine contamination has a significant negative effect on education levels. OLS estimates are much smaller than IV estimates which is consistent with the fact that measurement error attenuates OLS estimates. This is also consistent with the fact that more land mines were led in more prosperous regions. The suggested (IV) effect at the mean level of land mine contamination is an education loss of 0.183 years of education for each additional primary school year exposed to the conflict.

This loss at the mean level of conflict exposure equals 0.4 years of education. This effect is large given an average sample number of years of education of 4.5 years. As a comparison, consider the Indonesian school construction program evaluated by Duflo (2001). Between 1974 and 1978, the Indonesian government constructed 61,000 primary schools through the country. This is one of the largest school construction program on record. According to Duflo's estimates the impact of this program at the mean represented an education gain of 0.38 years for the cohort of children most exposed to the program.

Separate regressions for men and women indicate no significant effect on female education (not reported) and a larger effect on male education only. This probably reflects the fact that women had initially a level of education than men.

The impact on log earnings using OLS and IV are reported in columns 2 and 4 respectively. Although larger than OLS estimates, IV estimates do not have the expected sign and are insignificant statistically. Several explanations can be advanced to explain the absence of effect on earnings both related to the post-war context and to the identification strategy.

Hence, a first explanation is the possibility that land mine contamination has a direct impact on the returns to education through affecting the quality of education received or workers' health. To see this I test whether exposure to land mine contamination determines significantly the quality of education as reflected in literacy after controlling for the number of years of education (i.e. the quantity of education). The results derived using a probit model on a dummy for the *"individual is literate or not"* are reported in Table 4. Both OLS and IV estimates are insignificant and small in magnitude. Next, I evaluate the impact of land mine contamination on standard measures of school quality through 2005 (pupil over teacher ratio, pupil over class ratio, proportion of schools with access to water and toilet) using district level data provided by the Ministry of Education. The OLS specification reads as follows:

$$sq_{dp} = \alpha + \beta LC_d + \gamma_p + \varepsilon_{dp} \tag{10}$$

where sq_{dp} is a measure of school quality for district d in province p and γ_p is a province fixed effect.

The IV specification uses $Thai_d$ as an instrument for LC_d and includes $Laosian_d$ and $Vietnamese_d$ as exogenous controls.

The results are reported in Table 5. Both OLS and IV estimates show no significant relationship between land mine contamination and school infrastructure quality. The explanations are threefold. First, land mine contamination may have had an impact on both the numerators and denominators of these ratios thereby resulting in unchanged ratios. A less probable explanation is that public funds allocated to the education sector were effective in reducing any gap in school quality caused by the war[4].

Exposure to land mine contamination may also affect the returns to education through its impact on health[5]. The negative health effect of land mines may be larger

[4] There is no evidence of such intervention having taken place immediately following the conflict.

[5] Estimates of the number of individuals disabled vary considerably across sources from 1.5 per cent of the population in the 1997 socioeconomic survey (2.5 per cent for the sample I consider in this paper) to 15 per cent in Asian Development Bank (1999). 11 per cent of the disabilities are caused

for the older cohorts because they were more likely to be enrolled as soldiers. In the DD framework, a larger negative health effect on the old cohort combined with an equal negative education effect on the young cohort will smooth away the effect of land mines on earnings. This hypothesis is verified by directly estimating the effect of exposure to land mines on health as reflected in an individual's disability and illness status. The results are reported in Table 4 and indicate no more severe deterioration in health ouctomes for the older cohorts. These two pieces of evidence therefore invalidate the first explanation.

Another explanation relates to the legacy of the Khmer rouge regime. Between 1975 and 1978, Cambodia experienced a dramatic **country-wide** political shock: massive killings and starvation and an almost complete destruction of the school system. Estimates of the number of people killed vary between 2.5 and 3.5 million (Kiljunen (1984)). The Khmer Rouge targeted especially the educated and urban groups in the society, as they were seen as obstacles for the creation of a "new" society (see De Walque (2006) for evidence). This could be the explanation for the results on income – if the regime actively promoted uneducated individuals and put them in positions of authority and or in positions where they could gain experience, this could generate an inverse correlation between education and earnings that might outlast the regime.

A third factor that could drive down the effect of land mine contamination on earnings (through education) is the loss of physical capital including destruction of (or lost access to) public infrastructure and/or delay in technology adoption. Skill-

directly by landmines alone and another 10 per cent by other war related damages.

biased technological change has been often advanced has a cause of the increase in wage inequality in OECD countries like the US. In this context, the argument may be reversed to explain why land mine contamination causes a significant education loss but no income loss. The argument goes as follows: due to capital-skill complementarity the effect of a fall in education levels (caused by land mines) on earnings may be compensated by a fall in the returns to education caused by a negative shock to the stock of infrastructure and delays in technology adoption.

7 Conclusion

Land mine contamination causes a significant educational loss in Cambodia. A conservative estimate at the mean level of exposure suggests a loss of about 0.4 years of education. This represents a very large education setback given a sample average number of years of education of about 4.5 years and in comparison with the effects of large school construction programs. However, immediately after the end of the conflict, the effect on earnings is not (yet) visible. Since the survey was carried out in 1997, I have argued that the destruction of physical capital during the 30 years of war and long lasting effects of the Khmer rouge regime may be the major factors that drive down the returns to education in Cambodia post-war. No evidence is found that this could reflect a direct effect on the returns to education through health or education quality effects.

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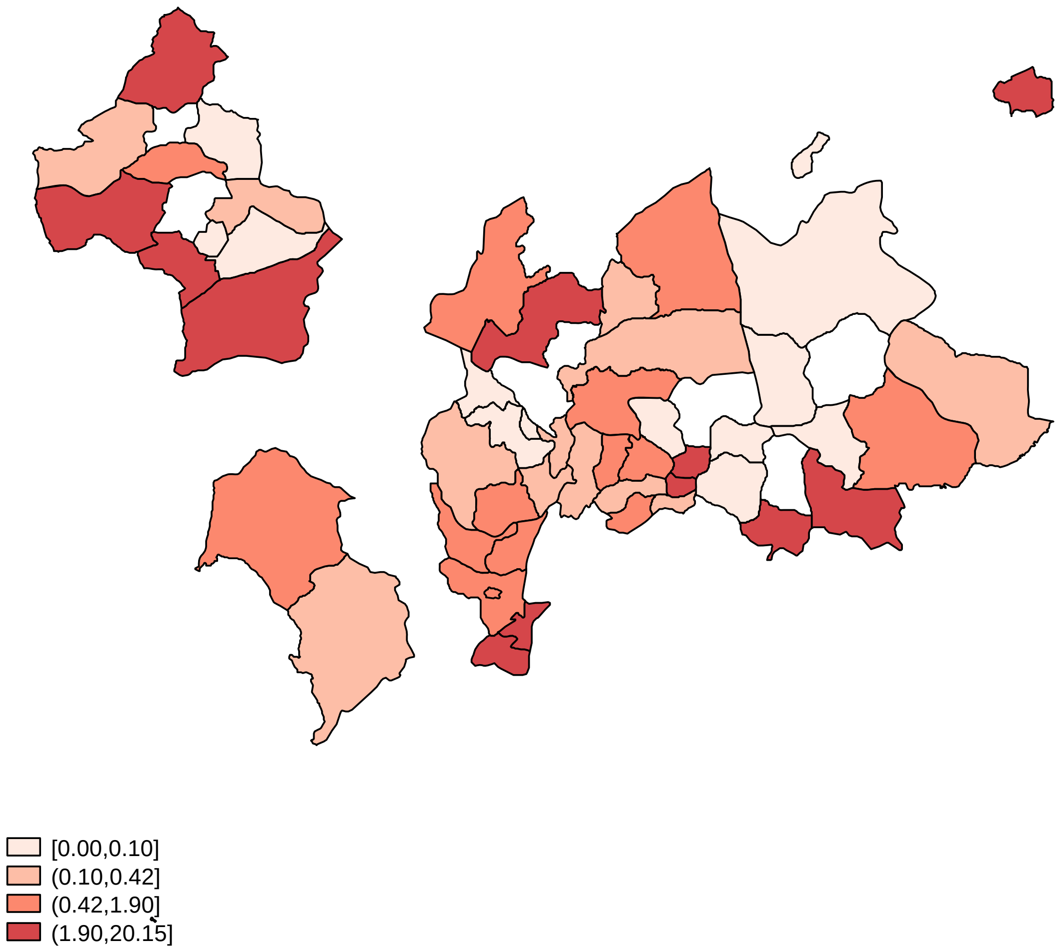

Landmine Contamination Intensity, Proportion of Land Surface Contaminated

Table 1--DESCRIPTIVE STATISTICS

	Mean	Standard Deviations
Education	4.34	3.85
Education (sample with valid earnings N=3252)	5.41	4.14
Log(Monthly Earning)	10.45	3.015
Number of Years Exposed to Conflict between age 6 and 12	3.29	2.66
Literacy (sample with vaild earnings)	0.023	0.15
Disability (sample with valid earnings)	0.803	0.397
Major Illness last 4 weeks (sample with valid earnings)	0.123	0.329
Proportion of Birth District Surface Landmined	0.69	2.21
Average fluency in Vietnamese in birth district	4.87	0.19
Average fluency in Laosian in birth district	4.86	0.24
Average fluency in Thai in birth district	4.89	0.27

Table 2-INSTRUMENTAL VARIABLES, First Stage

	Dependent Variable: **N*LC**	
	Whole Sample	Earning Sample
N*Thai	-1.155	-1.613
	(0.609)	(0.744)
N*Vietnamese	1.101	1.473
	(0.525)	(0.661)
N*Laos	0.481	0.537
	(0.293)	(0.320)
N==Number of years exposed to conflict between Age 6 and 12		
LC==Proportion of birth district surface contaminated by landmines		
Thai== Average district fluency in Thai in birth district		
Vietnamese== Average district fluency in Vietnamese in birth district		
Laos== Average district fluency in Laosian in birth district		
R-squared	0.65	0.67
Observ.	6703	3252

Note: All specifications include year of birth dummies and district dummies.
Clustered Standard deviations in parentheses

Table 3--Effect of Landmine Contamination on Education and Earnings

	OLS		IV	
	Education	log(Earnings)	Education	log(Earnings)
	(1)	(2)	(3)	(4)
N*LC	-0.013	0.007	-0.183	0.033
	(0.007)	(0.003)	(0.110)	(0.048)
R-squared	0.23	0.56	0.17	0.56
Obser.	6703	3252	6703	3252

N==Number of years exposed to conflict between Age 6 and 12

LC==Proportion of birth district surface contaminated by landmines

Note: All specifications include year of birth dummies and district dummies.
The instrument is the number of years exposed to conflict between age 6 and 12 interacted with district of birth average fluency in Thai. Controls are interactions of the number of years exposed to conflict between age 6 and 12 interacted with district of birth average fluency Laosian and Vietnamese . Clustered Standard deviations in parentheses

Table 4-- RETURNS TO EDUCATION, Marginal Effects Reported

		Probit			IV Probit		
		Literacy*	Disability	Illness	Literacy*	Disability	Illness
		(1)	(2)	(3)	(4)	(5)	(6)
N*LC	Whole sample	0.003	-0.01	0.0009	0.066	0.027	-0.085
		(0.006)	(0.004)	(0.003)	(0.065)	(0.038)	(0.051)
Obs. Whole sample		6703	5173	6452	6703	5673	6452

N==Number of years exposed to the conflict after age 6
LC=Proportion of district surface contaminated by landmines
Note: Sample of Individuals who report earnings. All specifications include year of birth dummies and district dummies.
(*) I control for the number of years of education.
The instrument is the number of years exposed to conflict between age 6 and 12 interacted with district of birth average fluency in Thai. Controls are interactions of the number of years exposed to conflict between age 6 and 12 interacted with district of birth average fluency Laosian and Vietnamese . Clustered Standard deviations in parentheses

Table 5--SCHOOL QUALITY, District Level Estimates

	Pupil/Teacher ratio (1)	Pupil/number classes (2)	Schools with water/Total (3)	Schools with toilet/Total (3)
OLS				
Proportion of district surface contaminated	1,492	0,142	0,0007	0,008
IV	(0,644)	(0,015)	(0,007)	(0,006)
Proportion of district surface contaminated	2,563	-5,022	-0,137	0,055
	(14,17)	(12,24)	(0,351)	(0,168)
Observ.	111	111	111	111

Note: All specifications include province fixed effects. Clustered Standard deviations in parentheses.
All regressions control for the average district fluency in Laosian and Vietnamese.
The instrumental variable is the average district fluency in Thai.