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Short and Long Run Effects of Earthquakes on Farm Businesses in Indonesia

Jérémie Gignoux², Marta Menéndez²

¹ Paris-Jourdan Sciences Economiques (PSE-INRA); gignoux@pse.ens.fr

² Université Paris-Dauphine (LEDa-DIAL); marta.menendez@dauphine.fr



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ABSTRACT

This paper studies the impact of earthquakes on farm business assets in rural Indonesia. Using a panel fixed effects model, we evaluate if the negative consequences of earthquakes extend beyond the immediate event into the medium and long-term. Our results suggest that rural households were able to recover in the medium-run, and even exhibit welfare gains in the long-run. Productive assets in farm businesses were on average reconstituted and even increased in the medium-run. Thus, reconstruction strategies after large earthquakes seem to provide incentives to small farm business holders to reconstitute and increase their investments.

Keywords: natural disasters; long-term effects; recovery; farm businesses.

JEL codes: I30, L26, O10, Q54.

1. INTRODUCTION

A large number of rural households living in Indonesia, a majority of the poor in this developing country as in others, are every year afflicted by natural disasters such as earthquakes, droughts or fires. These disasters destruct the productive capital of farm households, including their plantations, livestock, buildings, and machinery, or force a liquidation of those assets, and negatively affect their incomes and welfare. They disrupt marketing chains thus preventing farmers from accessing inputs or selling their production in remote markets. They also affect local labor markets and opportunities for agricultural wage and nonfarm employment. Whether, after such an event, rural households manage to reconstitute the productive capital of their farms, or find jobs that are sufficiently remunerated as agricultural workers or in other sectors, is crucial for their welfare in the long run.

While it may also have unintended effects notably by substituting the local agricultural production and reallocating labor from others to the construction sector, aid and reconstruction policy responses have the potential to mitigate, or even revert, the negative impacts of disasters by providing farmers the resources for reconstituting their productive capital or by re-building the infrastructures for accessing markets.

The objective of this study is to examine the effects, in the short and long run, of large earthquakes on the welfare and productive resources of Indonesian rural households, and to investigate some mechanisms driving those. Indonesia, the world's fourth most populous country, is located at the intersection of several tectonic plates and as a result, has to contend with one of the most frequent and powerful seismic activities in the world. Large sections of the country are exposed to seismic tremors. In addition, the unpredictability of such disasters makes it difficult for households to adopt short-run ex-ante risk-reduction strategies to mitigate their effects. While the destruction they entail to housing comes first in mind, those large earthquakes generate substantial losses among farm business and infrastructures, and the concerns above are acute in Indonesian rural areas.

The evidence on the impacts of earthquakes and other natural disasters on households is scant (Cavallo and Noy 2009). Cross-country macro studies tend to find negative short-term effects on economic growth, but with some heterogeneity: while severe impacts are consistently reported for large disasters, some studies report positive impacts, apparently through a reconstruction stimulus, of more moderate ones (Skidmore and Toya 2002, Loayza et al. 2012). The evidence on the mechanisms at play is thin. At the level of households, Thomas et al. (2010) point out that there are still uncertainties about the magnitudes of the welfare loss, its heterogeneity across groups and its persistence over time. In particular the few studies of households' coping with natural disasters in developing countries have focused on short-run effects (Carter et al. 2007, Rose 1011, Thomas et al. 2010), and investigated the long-run ones (with the exception of Mueller and Quisumbing 2010 and Mueller and Osgood 2009).

This gap can be explained in part by the lack of appropriate data (Thomas et al., 2010, Baez et al., 2013). Indeed, much of the evidence on the effects of natural disasters on household welfare relies on imperfect measures of natural hazards, based on individual reports from household questionnaires. These measures are subject to measurement error due to recall problems - this could bias the estimated effects of shocks - and to reporting bias if different groups of individuals systematically respond to the shock questionnaires differently.

In this study, we use high-quality large-scale longitudinal household surveys for Indonesia during the period 1993-2007, as well as objective measures of earthquakes, based on a U.S. Geological Survey catalogue of large seismic events. Given that the occurrence of earthquakes can be viewed as random when restricting to exposed regions, this setting permits to analyze these events as a set of repeated social experiments. In addition, this study relies on a very long term panel database (1993-2007), the Indonesian Family Life Survey (IFLS), which is known to have rarely low attrition rates – this is crucial for examining the long-run impacts of natural disasters. The use of the IFLS allows documenting both the short and long-term consequences of earthquakes, while minimizing the possibility of selection biases stemming notably from migrations.

We first seek to measure the short-run effects of earthquakes on rural household welfare, as measured by per capita consumption, and investigate whether they extend into the medium and long run. We secondly examine the effects on different types of farm business assets in order to investigate the channels driving the welfare effects. We also account for received aid and (wage and non-wage) incomes. To do so, we estimate a panel fixed-effects model which accommodates the facts that welfare outcomes are measured at the household level while the experience of an earthquake is measured at the individual level and that the composition of households changes across rounds.

Surprisingly, our results indicate that rural households who experienced a large earthquake in Indonesia, after going through short-term welfare losses, were able to recover in the medium run, and even exhibit welfare gains in the long-run. We also find evidence that the stock of farm productive assets is reconstituted and even increased in the medium-run. Our results suggest that received aid and infrastructure reconstruction allow, and provide incentives to, small farm holders to reconstitute and increase their productive capital.

This paper is organized as follows. Section 2 presents the data sources and variables used as well as descriptive statistics on earthquake incidence and intensity. Section 3 describes the methodology used for assessing the effects of earthquakes on household welfare. Section 4 includes an analysis of our findings. Section 5 concludes.

2. DATA SOURCES

In this paper we link data from two different sources: our first dataset consists on panel household surveys data for Indonesia including socio-economic characteristics of individuals as well as self-reported information on shocks experienced by households; our second dataset is a geological survey including detailed information and measures of earthquake incidence and intensity. Both datasets and the merging procedure we apply are described below.

2.1. *Panel household surveys data*

Household level microdata were gathered from the four full waves of the Indonesia Family Life Survey (IFLS), a large-scale longitudinal household survey that collects information on the lives of individuals, their households and family members, and the communities in which they live. The first wave was conducted in 1993 (IFLS1), and full follow-ups took place in 1997 (IFLS2), 2000 (IFLS3), and 2007 (IFLS4). A total of 7,224 households were interviewed in IFLS1, representing about 83% of the Indonesian population living in 13 of the nation's 26 provinces.¹ Subsequent waves attempted to reinterview these households and households to which previous household members had moved. The total number of households interviewed, including the split-off households, was 7,698 in IFLS2, 10,435 in IFLS3 and 13,535 (with 43,649 individuals) in IFLS4. Because substantial effort was done to track the movers, attrition rates in IFLS surveys is remarkably low. Overall, 87.6% of households that participated in IFLS1 are interviewed in each of the subsequent three waves.² In terms of individuals within households and for cost reasons, not all were interviewed in 1993 (in particular, not all children were included). However, from 1997 onwards, individuals aged 26 and more in 1993 and all their children were tracked, and in 2000 and 2007 tracking was complete for all members of 1993 households.

The outcomes considered in this paper include measures of: real monthly per capita household (total, food and non-food) consumption³ and farm-business assets (incl. land, buildings, and movable assets). For most variables, we use indicator variables for non-zero value (participation), and also the observed value; all those values are in real terms using deflators that incorporate inflation and spatial variations in prices.

In order to measure exposure to earthquakes, we recover the migration histories, at the subdistrict level, for all individuals in our survey, since 1985. The information on migration was obtained from two different sources in the survey: the tracking modules with information on the household's location in 1993, 1997, 1998, 2000 and 2007, and the specific (adult) individuals' migration modules with information on residence at birth, at age 12, and all moves after age 12 (with dates and place).⁴ IFLS respondents provide information on their places of residence since birth in the first 1993 round or in subsequent rounds, in case they enter the panel, and since the previous round at which they were observed in case they are re-interviewed; we extract all past subdistricts of

¹ The 1993 sample was elaborated by randomly selecting 321 villages from the 1993 National economic Survey (SUSENAS), spread among 13 Indonesian provinces, in particular, four provinces from Sumatra (North Sumatra, West Sumatra, South Sumatra, and Lampung), all of Java and four from the remaining islands (Bali, West Nusa Tenggara, South Kalimantan, and South Sulawesi).

² For more detailed discussions on IFLS attrition rates, see Thomas et al. (2010).

³ Spatial and time deflator obtained from Firman Witoelar, in 2007 Jakarta prices.

⁴ The construction of migration patterns has been greatly facilitated by the 2007 IFLS4 survey, which attempted to re-interview all 7,224 households interviewed in IFLS1, plus all of the newly formed households (split-offs) that first appeared in 1997, 1998 and 2000.

residence. For children's migrations, after checking that their care-taker was preeminently the mother throughout the survey, we imputed the migration histories of their mothers (or, exceptionally fathers or other care-takers, when mothers were missing from the household). Once we have constructed migration histories, three measures of exposure to an earthquake have been distinguished: short-run exposure (individuals declare to have been exposed to an earthquake during current and past survey years); medium-run exposure to earthquakes (during the four previous years); and long-run exposure (afterwards and up to 15 previous years).

2.2. Earthquakes data

Our second source of data is the Centennial Earthquake Catalog (Engdahl and Villaseñor, 2002), which contains objective measures of earthquakes occurrences and allows to estimate the local earth tremors they caused and that were felt by individuals in the IFLS panel survey.⁵

The Centennial catalog is a compilation of records of large earthquakes, obtained from seismographic instruments located around the world, that is made available by the U.S. Geological Survey. It has been assembled by combining existing catalogs and harmonizing the magnitude and location measures. For the period 1965-present, the Centennial catalog records earthquakes with a magnitude higher than 5.5 and is complete up that threshold. The Catalogue registers, for each seismic event, the date and exact time, epicenter's location, focal depth, magnitude (measure and scale)⁶, as well as details on the source catalog, recording technique and instruments. From the Catalogue, we selected all earthquakes that occurred since 1985 in the region surrounding Indonesia (geographic latitudes between -12 and +12 degrees and longitudes between 80 and 150 degrees); there are 1111 such earthquakes.

We exploit this data to measure the strength of ground motion that was locally felt by the households in the IFLS panel, and the subsequent amount of damage they were likely to suffer. A common geological measure of local hazard that earthquakes cause is peak ground acceleration (PGA), or the maximum acceleration that is experienced by a physical body, e.g. a building, on the ground during the course of the earthquake motion. PGA is considered as a good measure of hazard to short buildings, up to about seven floors.⁷

Though local measures of the ground motions induced by earthquakes are available only for selected locations where stand seismographic stations, the mapping of the felt ground shaking and potential damage can be imputed from the characteristics of earthquakes and the local geography. Seismologists and structure engineers have developed models, called attenuation relations, for predicting the local intensity of ground shaking caused by a given earthquake; these models serve notably for mapping seismic hazards. Attenuation relations are obtained by specifying a functional form, e.g. with PGA being a log-linear function of distance to the source fault among other terms,

⁵ We thank Professor Raul Madariaga (ENS) for helpful discussion and for directing us to this source of data.

⁶ Magnitudes are global measures of the size of earthquakes and are measured in terms of energy released by earthquakes in the Centennial catalog, usually using moment magnitude (M_w) scales (Hanks and Kanamori, 1979). The local magnitude scale (ML), also known as the Richter scale (Richter, 1935), as well as other older scales that appear in the catalog, such as the surface wave (M_s) or the body wave (mB) magnitudes (Gutenberg 1945) tend to underestimate the strength of large earthquakes. The M_w scale does not, and is thus the common scale for measuring the size of medium to large earthquakes.

⁷ The physical constraints put on those buildings during an earth tremor have been found to be strongly correlated with PGA. For taller buildings, peak ground velocity (PGV), the first integration of PGA, is viewed as a better measure of hazard.

and estimating the parameters using data for past earthquakes. Specific attenuation relations have been proposed for estimating ground motions for different regions, types of earthquakes, and distance ranges. The specific attenuation relation applied in this paper was derived by Zhao et al. (2006).⁸ This attenuation formula allows estimating the PGA induced by any earthquake in our selected dataset and for any subdistrict surveyed by the IFLS; subdistricts typically are small areas, rarely larger than 20 kilometers of diameter, and we take one set of geographic coordinates for each of those. Source distance x is easily obtained from the latitudes and longitudes of the subdistrict (“kecamatan”) and earthquake hypocenter locations. For each earthquake, we thus recover a mapping of the induced ground shaking felt in the IFLS subdistricts, with a measure of PGA for each subdistrict.

PGA measures can then be approximately converted to potential damages using the Modified Mercalli intensity scale: a well-known conversion rule (based on observations, reports of damages and perceived shaking) which has ten intensity levels, and where the upper six levels correspond to local ground motions with PGAs large enough to cause damage. Level 5 intensity level has PGAs between 3.9 and 9.2 percent of g (% g), and can cause very light damage, level 6 (PGAs between 9.2 and 18 % g) light damage, level 7 (PGAs between 18 and 34 % g) moderate damage, level 8 (PGAs between 34 and 65 % g) moderate to heavy damage, level 9 (PGAs between 65 and 124 % g) heavy damage, and level 10 or more (PGAs larger than 124 % g) very heavy damage. For each subdistrict in the IFLS panel surveys, we thus recover the PGAs that were experienced each year and the corresponding number in the Modified Mercalli intensity scale.

2.3. Merged dataset

The last step is to merge the earthquake subdistrict-level information with IFLS individuals. For each individual in the panel, we recover his history of exposure to ground shakings using the information from the specific subdistricts where the individual was living each year (migration histories are therefore taken into account) and the occurrence of ground shakings in those specific subdistricts and those years. Note that we compiled longitudes and latitudes for subdistricts that appear in any of the four waves of the household surveys. If an individual migrated to any other place, the associated geo-data and exposure to ground shakings for those areas could not be calculated. In any case, the share of such individuals remains very limited.⁹

Indonesia being one of the most seismically active regions in the world, large magnitude earthquakes occur frequently, in particular in the areas where the IFLS survey respondents live. Table 1 gives the list of earthquakes (and the information that is reported in the Centennial catalog) which caused earth tremors of intensity 7 or more felt in IFLS subdistricts. From this table we can already see that a relevant number of potentially damaging seismic events occur in the regions and period of the IFLS panel survey. Table 2 gives the number of individuals in our survey that were touched by these large earthquakes. There is no single year without at least some individuals affected by earthquakes of intensity 5 or more. The years with higher earthquake incidence, in terms of individuals affected, correspond are 1985, 1998, 2001, and 2007, when more than 10,000 individuals in our sample were touched.

⁸ We thank Stephan Harmsen (USGS) for his help on handling the seismic data.

⁹ Note that one must be careful not to impute in the survey year exposure to earth tremors that occurred after the households were interviewed, so that we consider only the earthquakes that happened during the first semester (all surveys were fielded during the second semester); we may however miss a few earth tremors affecting some panel households in late 1997 and 2007.

3. EMPIRICAL STRATEGY

To identify the short and medium-run welfare effects of earthquakes in Indonesia, we employ a fixed-effects panel econometric model. For this application, we need to accommodate the usual fixed-effects model to account for the facts that the welfare outcomes are measured at the household level while the experience of an earthquake is measured at the individual level and that the composition of households changes from one round of the panel to another.

Consider to start an individual-level panel model:

$$y_{ijt} = \alpha + \beta T_{ijt} + \lambda_i + \epsilon_{ijt} \quad (1)$$

where the welfare outcome, the experience of an earthquake treatment and the residuals vary with time, and λ_i are individual fixed effects. The issue is that only an average of the welfare outcomes at the household level is observed (e.g. the consumption expenditures aggregate is at the household level). Using an individual-level treatment would thus lead to a misspecification bias. In a cross-section setting, only a household-level averaged model would provide consistent estimates of the effects of earthquakes experience. However, in a longitudinal setting, individuals can exit from households and join others, so that household-level fixed effects are not relevant, and one needs to incorporate individual fixed effects in a household-level averaged model.

The household-level model is here obtained by taking the average and accounting for the fact that individuals can belong to different households at different dates:

$$\bar{y}_{jt} = \alpha + \beta \bar{T}_{jt} + \sum_{k \in K_{jt}} p_{tk} \lambda_k + \bar{\epsilon}_{jt} \quad (2)$$

where K_{jt} denotes the set of individuals k who belong to household j at date t . Because of these changes in household composition, the individual fixed effects need to be weighted by the shares p_{tk} of each individual represent of the number of household members (i.e. one divided by household size).

Now many household members, e.g. many couples, will remain together at all rounds of the panel. For those household members that are always observed together, individual fixed effects cannot be identified and can be replaced by fixed effects for the groupings of associated members. The weights p_{tg} will then consist on the shares of the number of household members represented by the individuals in the grouping at each date. The model we estimate thus writes:

$$\bar{y}_{jt} = \alpha + \beta \bar{T}_{jt} + \sum_{g \in G_{jt}} p_{tg} \lambda_g + \bar{\epsilon}_{jt} \quad (3)$$

where G_{jt} denotes the set of groupings of individuals (observed together) g who belong to household j at date t . In this model, treatment is defined at the household level and indicates whether

any household member experienced an earthquake during a given of time preceding the date observation (e.g. in the past two years).

This model can be estimated as long as the number of fixed effects and other independent variables is smaller than the number of observations. With four rounds of data and a number of individuals remaining together across the different waves, this constraint happens to be satisfied.¹⁰ The identification assumption is then the one usually formulated in fixed effects panel estimations. The fixed effects for groupings of individuals will control for time-invariant unobserved heterogeneity: the effects are identified using the longitudinal between variations by comparing the outcomes of households with the same members at dates after experiencing an earthquake and at other dates when they do not endure any earthquake. The main identifying assumption is that the experience of an earthquake is independent from the changes in unobserved determinants of welfare outcomes. The fact that the occurrences of earthquakes are to a large extent unpredictable makes it highly plausible.

The model above is estimated on an unbalanced panel of rural households with individuals aged 25 to 54, and fixed effects are included for the individuals in this age range or groupings of individuals who remain together across rounds. We exclude the observations of individuals in provinces where almost no one was affected by a large earthquake (of intensity of 5 or more). The size of the sample is about 15,000 observations.

4. RESULTS

Table 3 gives the estimates of the effects of earthquakes on total per capita consumption of rural households, and also food and non-food consumption separately. Our estimates show negative short-run effects of earthquakes experience on household per capita consumption, with large decreases in total (by 9%) and non-food consumption (12%). However those negative effects disappear in the medium run, and, in the long run, our estimates turn positive, with substantial increases in both food (11%) and non-food consumption (8%). Additional evidence (available upon request) shows that higher intensity earthquakes (7+) have larger negative effects in the short-run on consumption and also larger positive effects in the long-run.

Tables 4a and 4b report estimates of the effects on self-employment income and disaggregated farm business assets: house and land, other buildings, and movable assets (dummies and log of monthly value respectively). Our results show negative short-run effects on buildings' ownership and values, indicating substantial short-run losses in farm businesses. The point estimates are negative but statistically insignificant for the values of owned land and movable assets. Now, there are positive medium-run effects on ownership and value of movable assets (positive point estimates also on land and building but not statistically significant), suggesting that productive assets are reconstituted in the medium-run. There are large positive but not statistically insignificant long-run effects on most farm business assets.

Table 5 gives the estimates of the effects on the receipt of social assistance transfers. There are large positive short and medium-run effects, mostly through subsidized food assistance: food social assistance is important in the short and medium-run. In the long-run, some negative effects on other

¹⁰ The estimation of the model is still computationally intensive.

transfers provide another indication of the long-run welfare improvements. The 2007 IFLS wave includes specific information on infrastructure reconstruction after natural disasters. Since this information is not available for previous waves, we cannot use it in our panel estimations. However it provides evidence on how communities suffer infrastructure damages after natural disasters, but tend to reconstruct and enjoy better infrastructures after all. In this sense, descriptive statistics for 2007 show that 67% of communities that have suffered natural disasters declare damages in infrastructures. Among those communities having suffered infrastructure damages, 80% declare that repairs have been made, and that infrastructures are now as before or better off.¹¹

5. CONCLUSION

Using high-quality large-scale longitudinal household surveys for Indonesia for the period 1993-2007, we examine the effects of large earthquakes on rural household welfare in Indonesia, and investigate some mechanisms driving those. Surprisingly, our results indicate that households who experienced a large earthquake in Indonesia, after going through short-term welfare losses, were able to recover in the medium-run, and even exhibit welfare gains in the long-run. We also observe that the stock of productive assets in farm businesses is reconstituted and even increased in the medium-run. Our results suggest that reconstruction aid allows and/or provides incentives to small business holders to reconstitute and increase their investments.

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¹¹ We are currently conducting more detailed analysis of reconstruction and aid using community-level data.

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Table 1. List of earthquakes causing earth tremors of intensity 7+ felt by IFLS sample since 1993

day	month	year	depth	magnitude	type	latitude	longitude	onshore	type
15	2	1994	19,8	6,9	Ms	-5,007	104,251	1	crustal
6	10	1995	35,6	6,7	Ms	-2,009	101,447	1	slab
17	6	1996	590,9	7,9	Ms	-7,146	122,512	0	slab
7	7	1997	27,9	5,9	Mw	0,999	97,476	1	slab
28	9	1997	13	5,9	Mw	-3,782	119,655	1	crustal
28	9	1998	146,4	6,6	Mw	-8,182	112,337	1	slab
14	8	1999	98,1	6,4	Mw	-5,913	104,622	1	slab
11	11	1999	213,4	6	Ms	1,244	100,22	1	slab
25	5	2001	140	6,3	Mw	-7,85	110,04	1	slab
1	1	2004	43,5	5,8	Mw	-8,4	115,71	1	slab
30	6	2004	91	6,2	Mw	0,68	124,69	0	slab
23	1	2005	44,1	6,2	Mw	-1,28	119,84	1	slab
28	3	2005	33,7	8,6	Mw	2,05	97,06	0	interface
26	5	2006	19,7	6,3	Mw	-7,96	110,34	1	crustal
1	12	2006	204	6,3	Mw	3,39	99,09	1	slab
6	3	2007	24,1	6,3	Mw	-0,5	100,52	1	crustal
8	8	2007	290	7,5	Mw	-5,91	107,67	0	slab

Table 2. Sample individuals affected by earth tremors since 1993, by intensity

year	I5	I6	I7	I8	I9	I10
1993	916	0	0	0	0	0
1994	3660	215	0	0	0	0
1995	5650	198	0	329	0	0
1996	3442	1298	239	0	0	0
1997	1374	320	189	9	0	0
1998	6959	3573	683	1498	330	0
1999	3867	582	165	9	0	0
2000	2035	5	0	0	0	0
2001	6586	3370	1329	612	180	4
2002	1576	2	0	0	0	0
2003	3196	8	0	0	0	0
2004	3324	1628	150	473	0	0
2005	2994	594	30	0	0	0
2006	3054	1547	2742	617	179	81
2007	5809	3523	3240	5613	108	0

Table 3: Effects on per capita consumption

	Total consumption	Food consumption	Non-food consumption
Earthquake experienced in years t to t-1	-0.0888** (0.045)	-0.0378 (0.045)	-0.1243** (0.059)
Earthquake experienced in years t-2 to t-5	-0.0158 (0.038)	-0.0392 (0.040)	0.0083 (0.049)
Earthquake experienced in years t-6 to t-15	0.0963*** (0.037)	0.1069*** (0.039)	0.0789* (0.047)
R-squared	0.800	0.763	0.794

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include time and groupings of individuals fixed effects. Additional controls include the province of residence and several characteristics of the household head (gender, age and education).

Table 4a: Effects on the value (in logs) of income and farm business assets

	Income and asset values (in logs)			
	Self- Employment income	Land	Other buildings	Movable assets
I6+ Earthquake experienced in years t to t-1	0.0099 (0.032)	-0.1701 (0.500)	-0.8170** (0.332)	-0.0525 (0.396)
I6+ Earthquake experienced in years t-2 to t-5	0.0528* (0.028)	0.1476 (0.442)	0.2678 (0.325)	0.7544** (0.370)
I6+ Earthquake experienced in years t-6 to t-15	0.0251 (0.027)	0.2143 (0.445)	0.1371 (0.309)	0.3857 (0.352)
R-squared	0.791	0.833	0.710	0.825

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include time and groupings of individuals fixed effects. Additional controls include the province of residence and several characteristics of the household head (gender, age and education).

Table 4b: Effects on the ownership of income and farm business assets

	Income and asset ownership			
	Self- Employment income	Land	Other buildings	Movable assets
I6+ Earthquake experienced in years t to t-1	-0.0047 (0.339)	-0.0111 (0.031)	-0.0628** (0.026)	0.0042 (0.031)
I6+ Earthquake experienced in years t-2 to t-5	0.5180* (0.287)	0.0145 (0.026)	0.0272 (0.025)	0.0578** (0.027)
I6+ Earthquake experienced in years t-6 to t-15	0.3080 (0.286)	0.0179 (0.027)	0.0126 (0.024)	0.0286 (0.027)
R-squared	0.826	0.827	0.710	0.817

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include time and groupings of individuals fixed effects. Additional controls include the province of residence and several characteristics of the household head (gender, age and education).

Table 5 Effects of the receipt of social assistance transfers

	any assistance	subsidized food assistance	other assistance (incl. cash)
I6+ Earthquake experienced in years t to t-1	0.0983*** (0.034)	0.0946*** (0.034)	-0.0174 (0.021)
I6+ Earthquake experienced in years t-2 to t-5	0.2283*** (0.033)	0.2073*** (0.033)	0.0225 (0.020)
I6+ Earthquake experienced in years t-6 to t-15	-0.0275 (0.027)	-0.0240 (0.027)	-0.0368** (0.017)
R-squared	0.863	0.860	0.835

Note : Standard errors (in parentheses) are robust to heteroskedasticity. All regressions include time and groupings of individuals fixed effects. Additional controls include the province of residence and several characteristics of the household head (gender, age and education). *** significant at 1%; ** significant at 5%; * significant at 10%.