**Universidad de San Andrés**

**Departamento Académico de Economía**

**Licenciatura en Economía**

# *The Impact of Natural Disasters on Welfare: Evidence from the Chilean Earthquake*

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**Buenos Aires, Victoria, mayo 2015**

# THE IMPACT OF NATURAL DISASTERS ON WELFARE: EVIDENCE FROM THE CHILEAN EARTHQUAKE

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**Abstract**

In February 2010, Chile was hit by an earthquake, which was followed by a tsunami. It is considered as the sixth strongest earthquake ever measured. In this paper, I exploit the exogenous exposure of individuals to this geological event to evaluate the short term effects of such a negative shock on children's and adult's welfare. Findings, together, point towards natural disasters having negative consequences on welfare and coincide with those carried out in previous studies. While I find no significant effect of the earthquake on school attendance, I find a negative impact on health conditions for children exposed to the natural disaster in comparison with a group of children not exposed to the natural disaster. Besides, labour force participation decreased among affected children. I also find that adults exposed to the shock were more likely to suffer from health problems. This result is confirmed by the self-evaluation of health variable, which is also statistically significant and negative. Besides, adults affected by the earthquake were more likely to be unemployed, and those unemployed individuals affected by the earthquake were less likely to be seeking for a job.

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## I. Introduction

Natural disasters can be defined as temporary events triggered by natural hazards that overwhelm local response capacity and seriously affect the social and economic development of a region (Anderson, 1990). As the Centre for Research on the Epidemiology of Disasters (CRED) informs, between 1994 and 2013, "there were 6,873 natural disasters reported worldwide, which claimed 1.35 million lives or almost 68,000 lives on average each year. In addition, 218 million people were affected by natural disasters on average per annum during this 20-year period" (CRED, 2015, p. 7). CRED estimates that "earthquakes (including tsunamis) killed more people than all other types of disaster put together, claiming nearly 750,000 lives between 1994 and 2013. Tsunamis were the most deadly sub-type of earthquake, with an average of 79 deaths for every 1,000 people affected, compared to 4 deaths per 1,000 for ground movements" (p. 7).

On February 27, 2010 Chile was hit by an earthquake measuring 8.8 MW, according to the United States Geological Survey (USGS). In fact, USGS (2010) reports that it was the strongest earthquake affecting Chile since the 9.5 MW magnitude 1960 Valdivia earthquake (the most energetic earthquake ever measured in the world), and it was the strongest earthquake worldwide since the 2004 Indian Ocean earthquake and until the 2011 Tōhoku earthquake. It is considered as the sixth strongest earthquake ever measured, approximately 500 times more powerful than the 7.0 M earthquake in Haiti one month prior, in January 2010 and even much stronger than the 2015 Nepal earthquake, which killed more than 7,000 people. According to Chile's Seismological Service, the 2010 Chilean earthquake first affected the south central region of Chile, and was then followed by a tsunami that caused major damage over more than 500 kilometres of coastline. Following official sources from the Chilean Undersecretary of the Interior, 525 people lost their lives, 25 people went missing and about 80% of the population of Chile experienced intensity VII or stronger shaking.

In this paper, I analyse the short-term effects of the Chilean earthquake in 2010 on children's and adult's welfare. Since the impact and severity of the earthquake varied across regions, I exploit this exogenous variation as a natural experiment to evaluate the impact of this shock. The main finding is a negative causal effect of the earthquake on welfare. I use data from the *Encuesta de Caracterización Socieconómica Nacional* (CASEN) carried out in 2009 and in 2010. The CASENs are very rich panel surveys at the household and individual level that gather information on a wide range of topics. In the months of May and June 2010, interviewers went back to the areas affected by the earthquake, where households had been surveyed months earlier in the 2009 round. The aim was to generate the needed information to evaluate the changes in the welfare of affected and non-affected people by earthquake/tsunami.



Natural disasters, like the Chilean earthquake, often represent an adverse shock to household's assets, their existing infrastructure, the health environment, and the macroeconomic conditions of the country. However, it is also usually argued that the humanitarian aid and the resources received from national and international organizations in the aftermath of major natural disasters could contribute to recover and increase the stock of public and private capital as well as to improve several dimensions of human welfare- even when compared to pre-shock levels. This belief is generally given as an example of the *Broken Window Fallacy*, introduced by Frederic Bastiat in 1850 in his essay "That Which is Seen and That Which is Unseen." Bastiat illustrated why destruction, as well as the resources spent to recover from destruction, are not actually a net benefit to society. Evidence presented in this paper backs Bastiat's lesson, at least in the short term.

From a household perspective, natural disasters can represent a multifaceted shock to welfare. There are three categories of impact on an individual's or a household's welfare: physical integrity, assets or income, and employment (Charveriat, 2000).

Regarding physical integrity, fatalities are a direct and immediate effect of the disaster, and they constitute a permanent shock to a household's welfare. In addition to fatalities, disasters can have various adverse effects on an individual's physical integrity, as they can cause serious or permanent injuries that can lead to a fall in income and an increase in health-related expenditures. Sickness and violence can also accompany disasters.

Concerning the impacts on household's economics, weather-related shocks can also affect household welfare through homelessness, as well as the loss of productive assets (i.e. housing and income-generating assets) and income.

The effect of disasters on employment, though, is still largely unknown. According to Charveriat, the impact of disasters on unemployment relies on the degree of destruction of income-generating assets and the period of disruption of flows of goods and services. As a consequence, it is plausible that the frictional unemployment generated by a disaster results in a long-term reduction of income, which might be driven by the lack of alternative sources of employment in the affected areas, and by limited or slowly executed reconstruction activities.

The results I find suggest a negative causal impact on the above mentioned dimensions of welfare. While I find no effect of the earthquake on children's school attendance, I find a statistically significant negative effect on children's health conditions. Furthermore, labour force participation for children older than 12 years old decreased after the earthquake. However, this result is quite difficult to assess, as "child labour" is defined by the International Labour Organization (ILO, 2015) as "work that deprives children of their childhood, their potential and their dignity, and that is harmful to physical and mental development". However, ILO also states that not all work done by children should be classified as child labour. Children´s or adolescents' participation in work that neither affects their health and personal development nor does it interferes with their schooling is generally regarded as being something positive.

Related to adults, I find that their health condition worsened as well as their self-evaluation of health. Besides, results show a negative impact on employment and job search. These findings may suggest that frictional unemployment could arise as a consequence of natural disasters.

What is empirically known to date regarding the effects of natural disasters emerges basically from two strands in the literature: (i) a dominant approach, which has examined the effects of these events on country-level variables, and (ii) a parallel and growing literature on microeconomic development, which has focused on the human welfare consequences of shocks.

The dominant approach, and also the traditional one, has reported the effects of large natural shocks on aggregate measures such as GDP, GDP growth, indebtedness, inequality and damages to the environment (Charveriat, 2000; IADB, 2000, CEPAL, 2001). This body of research has shown that natural disasters have negative and persistent effects on country-level variables in the short and medium term, and these impacts tend to be unequally distributed, as the poor and most vulnerable sections of the affected population seem to carry most of the burden of the costs.

The second approach, which comes from a growing literature, has rigorously documented the human welfare consequences of shocks, either natural (e.g. climate-related disasters) or man-made (e.g. economic downturns, conflicts). As summarised by

Baez and Santos (2008, p. 7), this literature has explored the impacts of these phenomena on many different but related household and/or individual level responses: the ability of households to smooth consumption (Deaton, 1992; Paxson, 1992; Townsend, 1994 & 1995; Jalan et al., 1999, Morduch, 2002; Skoufias, 2002), the production and investment behavior of farmers (Biswanger et al., 1993; Rosenzweig et al. 1993, Fafchamps et al., 1998; Kazianga et al., 2006), labour supply adjustments (Cunningham, 2001; World Bank, 2003), child labour (Beegle et al, 2003; Vakis, et al., 2004), school attendance (Jacoby et al., 1997; De Janvry et al., 2004), nutrition and health outcomes (Foster, 1995; Jensen, 2000; Hoddinott et al., 2000 & 2001), and migration (Jalan et al., 1999). Overall, these studies have long stressed the negative effects of these events on welfare, in particular for poor, credit constrained and uninsured households.

Yet, just a few papers focus specifically on the susceptibility of different dimensions of human well-being to major disasters. Baez and Santos (2007) studied the medium term impact of Hurricane Mitch in Nicaragua to report a negative impact on child nutrition and a null impact on school enrolment for children aged to 6 to 15 living in affected areas. Santos (2010) explored the short term impact of the two 2001 earthquakes in rural areas in El Salvador. The author found that rural children aged 6 to 15, who were highly exposed to the shocks, became less likely to attend school. Bustelo (2011) examined the short term impact of Tropical Storm Stan, which hit Guatemala in 2005. Results in his study emphasize a great deal of heterogeneity by age and gender in terms of how children's time allocation was affected by the storm. Bustelo (2012) studied the impact of the 1999 Colombian Earthquake on child nutrition and schooling. Findings report a strong negative impact of the earthquake on child nutrition and schooling in the short-term.

Three additional general features characterize the majority of the literature on the subject and help illustrate the contributions of my work. First, most of the papers have looked at shocks –or proxies of them– that cause transitory fluctuations in income. Therefore, with few exceptions, existing work has ignored that large and aggregate disasters such as earthquakes also have wider effects on household welfare. Secondly, many papers lack credible identification strategies, as they use cross-sectional data or cannot exploit suitable variation in exposure to natural disasters. Finally, the body of economic literature that explores the effects of a natural disaster on unemployment is still very limited. This paper aims to shed light on the labour dynamics and individuals' decisions following such a negative shock, and it constitutes valuable information for policy makers interested in designing comprehensive policies to deal with major disasters.

The organization of this paper is as follows: Section II describes the Chilean earthquake and presents the data. Section III reports the empirical identification strategy. Section IV presents results. Finally, section V concludes.



## II. Chilean Earthquake and Data

On February 27, 2010, a severe earthquake measuring 8.8 MW struck the south central region of Chile. The epicentre was located in the sea, in front of Curanipe and Cobquecura, and had a depth of 47.4 kilometres beneath the earth's crust. Over 12 million people (about 80% of the Chilean population) experienced intensity VII or stronger shaking. The earthquake produced a tsunami that caused major damage over more than 500 kilometres of coastline. The earthquake and tsunami together resulted in 526 deaths (with 31 persons still missing). The most affected regions by the telluric impacts were Valparaíso, Metropolitana de Santiago, O'Higgins, Maule, Biobío and la Araucanía. Figure 1 shows affected regions in the Chilean map.

The 2010 earthquake is considered to be the second strongest in Chilean history and the sixth strongest registered by a seismograph. According to the Pacific Earthquake Engineering Research, the total estimated loss of US$ 30 billion (18% of Gross National Product) is composed of US$ 21 billion to physical assets (including housing, buildings, schools and roads) and US$9 billion in business and indirect losses.

I use data from the *Encuesta de Caracterización Socieconómica Nacional* (CASEN) carried out in 2009 and in 2010. The CASENs are very rich panel surveys at the household and individual level that gather information on a wide range of topics, including income, education, health, housing and social capital. After the earthquake, with the aim of generating the needed information to evaluate the changes in the welfare of people affected by the earthquake/tsunami, the Planning Ministry decided to do a follow up of the 2009 survey in order to assess the effects of the earthquake at the individual and household level. In the months of May and June 2010, interviewers went back to the areas affected by the earthquake, where households had been surveyed months earlier, in the 2009 round. The interviewers followed the households located in 2010 in the areas affected by the earthquake- even when they moved out of the municipality-as long as they stayed in the same region as in 2009.[2]

Using this information, it is possible to identify in 2010 those households directly affected by the earthquake. The sample is composed of 22,118 households (75,986 people), of which 80 percent were affected by the natural disaster and are part of the treatment or experimental group, and those remaining represent the control group. The sample is representative at a national level and the percentage of people in the treatment group coincides with the percentage of people living in the areas considered as affected.

[2] Interviewers were instructed with a series of strategies of research in order to locate households that had moved after the 2009 round.

Taking advantage of the timing of the CASEN datasets, I try to identify the short term impacts of the 2010 earthquake on children's and adults' welfare. Regarding children, the outputs of interest are health condition, school attendance and labour participation. Related to adults, I measure the effects of the impact through four main variables: health condition, self-evaluation of health, labour participation and job search.

The individuals´ health condition is measured by the question: "Have you had any health-related problem in the last 30 days?" Besides, individuals older than 18 years had to answer how they considered their general health condition. They could answer in a scale from 1 to 7, 1 being "really bad" and 7 "very good". This variable is known as Self-Evaluation of Health.

The questions that measure the level of labour activity were: "Last week, did you work at least one hour without taking into account housework?" and unemployed individuals were also asked: "Have you sought for a job in the last four weeks?" Only binary answers were allowed: affirmative and negative.

Finally, the school enrolment variable is measured through the following question: "Are you attending an educational institution, kindergarten or any preschool program? Once again, binary answers were allowed.

The database also includes information about numerous individual and household characteristics, which are: Gender (a dummy that takes the value of one for male), Age, Number of people at the house, Urban area (a dummy that takes the value of one when the individual lives in urban areas), Poverty[3] (a dummy that takes the value of one when the individual is below the poverty line), Head of Household (a dummy that takes the value of one when the head of household is a male), Years of Schooling,

[3] In CASEN surveys, poverty is estimated dividing the total household income by number of people in the house and then comparing it with the poverty lines available.

Labour Income (measured by the monthly income and expressed in Chilean pesos) and Household Income per capita (measured by the monthly household income per capita and expressed in Chilean pesos).

In Table 1, a statistical summary at the national level for adults and children of all the previously mentioned variables is reported.

## III. Empirical Identification Strategy

This paper seeks to measure the effect of a large and multifaceted shock on children's and adults' welfare. Ideally, we would like to calculate the effect of the earthquake on an individual dimension of well-being by comparing the actual outcome of the person affected with what the outcome would have been in the absence of the shock. As this counterfactual cannot be observed, a comparison group is used. In order to do that, I use information about individuals' characteristics before and after the shock, and exploit the fact that the impact of the earthquake was an exogenous event dividing the population into two groups: those affected by the earthquake (treatment group) and those who were not affected (control group). The approach is based on a difference-in-difference analysis. Hence, I compare the changes in a set of outcome variables between 2009 and 2010 for people in households affected by the shock, relative to the changes present in people of households not affected by the negative shock. The region-level panel dimension of CASEN data generates the variation needed to identify the effects of the earthquake.

The baseline specification is:

$$Y_{it} = \beta Earthquake_{it} + \alpha X_{it} + \theta_i + \mu_t + \varepsilon_{it}$$

where $Y_{it}$ denotes the outcome of interest for individual *i* for the year *t*; $Earthquake_{it}$ is a dummy variable that takes the value of one if the individual *i* was living in one of the six affected regions by the earthquake, i.e. Valparaíso, Metropolitana de Santiago, O'Higgins, Maule, Biobío, and la Araucanía in year $t$; $X_{it}$ is a vector that consists of control variables that change over time and space; $\theta_i$ is a dummy individual variable to control for unobservable confounding variables that differ across individuals but are constant over time; $\mu_t$ represents the year fixed effects that accounts for the average changes in the outcome of interest across all regions between 2009 and 2010 and $\varepsilon_{it}$ is the error term.

The error is assumed to be independent across time and space; however, as the analysis uses panel data, the errors could be correlated across time in the same individual. If there were a positive correlation, this would make the model compute the standard errors smaller and the null hypothesis could be over rejected. So, in order to avoid potential biases, standard errors are clustered at individual level. It should be stressed that if the individual errors are highly correlated, clustering standard errors may reduce the statistical power of the estimation.

The main coefficient of interest is $\beta$. The identification assumption is that the result in the control group is an unbiased estimator of what the effects of the earthquake on the treatment group would have been in the absence of the earthquake. This assumption cannot be tested. However, it is possible to perform a t-test of equality of means to compare the characteristics and outputs of the different groups in the pre-treatment period. If characteristics in the affected and non-affected regions were similar before the shock, the approach would be valid. Tables 2 and 3 test this point by comparing groups along a number of dimensions in the year 2009, a pre-earthquake year. Before the earthquake, the outcomes of interest for children and adults are statistically indistinguishable between affected and non-affected individuals. Regarding pre-treatment characteristics, I find some significant differences between groups. I observe that individuals living in areas with the adverse shock are more urban, poorer and have a lower household income per capita. These differences are overall explained by a higher degree of urbanization and poverty in the areas affected by the earthquake. There are other differences in terms of years of schooling and the proportion of heads of households. This potential bias will be addressed later by controlling for individual characteristics when performing the regressions.

By checking that there are no differences in outcomes of interest variables and groups are similar, and having accounted for the fact that affected individuals were more likely to be located in urban areas and being poorer, the difference-in-differences approach could be taken as valid.

## IV. Results

I begin by reporting results regarding children outcomes in table 4, which shows estimations for a model that includes the treatment dummy, the year dummy and the individual dummies. While I find no significant effect of the earthquake on school enrolment for children aged 6 to 18 years old, the effect of the earthquake is statistically significant and negative as regards labour force participation (estimated for children older than 12 years olds) and health condition variables (estimated for children older than 1 years old). Results with and without controls indicate that children exposed to the negative shock suffered from health problems and their labour participation decreased.

Results concerning adults are presented in table 5, which, again, shows results for a model that includes the earthquake dummy, the year dummy and the individual dummies. Adults are aged from 18 to 60 years old. As shown in column 1 of table 5, the coefficient of the labour participation variable is negative and significant at the 1% level, suggesting that adults affected by the earthquake could not join the labour market in the short term. To determine why adults affected by the shock might not have been working, I perform regressions using a job search variable. During the survey, adults were asked if they had been seeking for a paid job in the last four weeks. Column 3 reports estimates of β when the dependent variable is job search. The coefficient is negative and significant at the 5% level. Results indicate that adults affected by the shock were neither working nor searching for a job.

What about health conditions of adults? As observed in column 5, the coefficient of health problems is negative and significant at the 1% level. The fact that the earthquake affected health also appears to be backed by the self-evaluation of health made by individuals. When adults were asked how they would evaluate their general health, they had to answer on a scale of 1 to 7, 1being "really bad" and 7 "very good". In column 7, the coefficient of self-evaluation of health is not only negative but also significant at the 1% level.

In columns 2, 4, 6, and 8, I control for the set of individual characteristics available. Once again, the values of the coefficients of interest remain significant and with the appropriate sign.

The difference-in-differences analysis so far has shown that the earthquake had a large and negative effect on treated children and adults.

I also run a series of additional robustness checks, in which the units of analysis are households affected by the earthquake relative to households not affected by it. In order to do so, I generated a new dataset containing observations at the household level by grouping individual observations belonging to the same house. Therefore, I estimated the effects through the following variables: labour participation, job search and health problems. For labour participation and job search, I kept observations for households' members older than 12 years old and I created dummy variables that took the value of one if at least one individual at the house was working or seeking for a job, respectively. Regarding the health problems variable, I kept observations for households' members older than 1 year old and I created a dummy variable that took the value of one if at least one individual in the house had had health problems.

Estimations include a treatment dummy, a year dummy and household dummies. Standard errors were clustered at the household level. As reported in columns 1 to 6 in Table 6, the conclusions remain unchanged for labour participation, job search and health problems of variables. The estimates are strongly significant.

## V. Conclusion

The devastating consequences of large natural disasters on socioeconomic systems are evident to all. Yet, little is really known about the magnitude of such negative effects on welfare. This paper estimates the effects of an earthquake followed by a tsunami in Chile in February 2010 on individuals' welfare. I exploit the exogenous variation in the impact of this geological event, which divides the country's population into two groups: those affected by the earthquake and those who were not affected.



The main findings point towards natural disasters having negative consequences on welfare and coincide with those carried out in previous studies. I report that adults exposed to the shock suffered from health problems. This result is confirmed by the self-evaluation of health variable, which is also statistically significant and negative. Besides, adults affected by the earthquake are more likely to be unemployed and they are less likely to be searching for a job. This last estimation suggests that frictional unemployment is plausible after a natural disaster and seems to be correlated with affected unemployed individuals who do not seek for a job.

Regarding children, results show no effect on school attendance. However, I find a substantial negative impact on the health condition of treated children relative to a comparison group. I also find a decrease in children's labour force participation, but it is quite difficult to figure out if this result means a deterioration in child's welfare, as child labour is generally associated with work that deprives children of their childhood, their potential and their dignity, and that is harmful to physical and mental development.

The findings in this paper highlight key points for setting priorities of public programs. Chilean earthquake has not only had a significant economic impact on the country's infrastructure but it also has had important social repercussions, which are related to a worsening in the quality of life of the population due to the direct impact on individuals´ physical integrity, unemployment and the destruction of property and material goods. In general, governments in the Latin American region have focused their policies on getting prepared for and responding to disasters, rather than actively reducing risks. Initiatives to mitigate risk have been few in the region and remain small-scale, uncoordinated efforts. The evidence presented in this paper shows that such a negative impact deserves serious policy attention and would need to be addressed with risk management strategies.

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**Figure 1. Map of Chile with regions affected by the earthquake**

**Table 1. Summary Statistics**

| | Mean | Standard Deviation |
|---|---|---|
| Children | | |
| Gender | 0.516 | 0.499 |
| Age | 9.899 | 5.478 |
| Number of people in the house | 4.910 | 1.623 |
| Urban Area | 0.726 | 0.450 |
| Poverty | 0.285 | 0.455 |
| Household income per capita | 101,061.3 | 96,585.3 |
| School attendance | 0.833 | 0.377 |
| Labour participation | 0.049 | 0.194 |
| Health Problems | 0.089 | 0.285 |
| Treatment Group (%) | 0.782 | |
| Adults | | |
| Gender | 0.482 | 0.499 |
| Age | 37.739 | 12.586 |
| Marital Status | 0.404 | 0.490 |
| Number of people in the house | 4.377 | 1.723 |
| Head of household | 0.339 | 0.470 |
| Years of schooling | 10.197 | 3.844 |
| Poverty | 0.184 | 0.388 |
| Labour Income | 120,771.3 | 193,556.4 |
| Household income per capita | 133,714.6 | 142,334.8 |
| Urban Area | 0.716 | 0.450 |
| Labour Participation | 0.550 | 0.490 |
| Job Search | 0.149 | 0.346 |
| Health Problems | 0.114 | 0.318 |
| Self-Evaluation of Health | 5.430 | 1.220 |
| Treatment Group (%) | 0.802 | |

Notes: Each mean was calculated taking into account years 2009 and 2010. The total number of observations for children is 20,970 and for adults is 43,354.

**Table 2. Pre-Shock Summary Statistics by Treatment Status (children)**

| | Treatment | Control | Difference of means |
|---|---|---|---|
| Health Problems | 0.086 | 0.082 | 0.004 |
| | (0.002) | (0.004) | (0.005) |
| School attendance | 0.817 | 0.816 | 0.001 |
| | (0.003) | (0.006 ) | (0.006 ) |
| Labour force participation | 0.047 | 0.042 | 0.005 |
| | (0.002) | (0.004) | (0.005) |
| Age | 10.352 | 10.038 | 0.314*** |
| | (0.041) | (0.077) | (0.087) |
| Gender | 0.516 | 0.518 | -0.002 |
| | (0.004) | (0.007) | (0.008) |
| Number of people in the house | 4.848 | 4.964 | -0.116*** |
| | (0.012) | (0.025) | (0.027) |
| Urban Area | 0.721 | 0.702 | 0.019 |
| | (0.003) | (0.007) | (0.007) |
| Poverty | 0.285 | 0.212 | 0.073*** |
| | (0.003) | (0.006) | (0.007) |
| Household income per capita | 102,003.8 | 122,701.9 | -20,698 *** |
| | (839.984) | (1,732.345) | (1,842.524) |
| Number of observations | 16,455 | 4,515 | |

*Notes:* Standard errors are in parentheses. Treatment corresponds to children living in areas affected by the earthquake. Control corresponds to children living in areas not affected. Health Problems is a dummy equal to 1 if the child had a problem of health in the last month. School attendance is a dummy equal to 1 when the child attends an educational institution. Child labour force participation is a dummy equal to 1 when the child works and is older than 12 years. Gender is a dummy equal to 1 when the child is male. Urban area is a dummy equal to 1 when the child lives in an urban area. Poverty is a dummy equal to 1 when the child is poor. Monetary values are expressed in Chilean pesos. The number of observations is 20,970. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level, based on a t-test of equality of means.

**Table 3. Pre-Shock Summary Statistics by Treatment Status (adults)**

| | Treatment | Control | Difference of means |
|---|---|---|---|
| Health Problems | 0.126 | 0.127 | -0.001 |
| | (0.002) | (0.003) | (0.004) |
| Self-evaluation of health | 5.399 | 5.464 | -0.065*** |
| | (0.007) | (0.013) | (0.015) |
| Labour participation | 0.514 | 0.527 | -0.012 |
| | (0.004) | (0.007) | (0.004) |
| Job search | 0.159 | 0.146 | 0.012 |
| | (0.003) | (0.007) | (0.008) |
| Age | 37.763 | 37.765 | -0.002 |
| | (0.067) | (0.134) | (0.151) |
| Gender | 0.481 | 0.486 | -0.005 |
| | (0.003) | (0.005) | (0.006) |
| Marital status | 0.419 | 0.376 | 0.043*** |
| | (0.003) | (0.005) | (0.004) |
| Head of Household | 0.325 | 0.350 | -0.025*** |
| | (0.002) | (0.005) | (0.006) |
| Number of people in the house | 4.336 | 4.359 | -.023 |
| | (0.009) | (0.019) | (0.021) |
| Years of schooling | 10,123 | 10,279 | -0.156*** |
| | (0.021) | (0.041) | (0.046) |
| Urban area | 0.721 | 0.699 | 0.022*** |
| | (0.002) | (0.005) | (0.005) |
| Poverty | 0.182 | 0.137 | 0.044*** |
| | (0.002) | (0.004) | (0.004) |
| Labour income | 121,538 | 142,416 | -20,877,5*** |
| | (1,050.130) | (2,363.201) | (2,415.919) |
| Household income per capita | 135,309.2 | 162,976.7 | -27,667.6*** |
| | (796.0304) | (1,868.525) | (1,850.324) |
| Number of observations | 34,750 | 8,604 | |

*Notes:* Standard errors are in parentheses. Treatment corresponds to people living in areas affected by the earthquake. Control corresponds to people living in non-affected areas. Health Problems is a dummy equal to 1 if the person had a health problem in the last month. Self-evaluation of health indicates how the individual ranks his health (better self-evaluations as it increases). Labour force participation is a dummy equal to 1 when the individual works. Job search indicates if the individual has been searching for job. Male is a dummy equal to 1 when the person is male. Head of household is a dummy equal to 1 if the individual is the head of a household. Urban area is a dummy equal to 1 when the person lives in an urban area. Poverty is a dummy equal to 1 when the person is poor. Monetary values are expressed in Chilean pesos. The number of observations is 43,354. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level, based on a t-test of equality of means.

**Table 4. The effects of earthquake on children**

| | School attendance | | Health Problems | | Labour force participation | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Impact of the shock | -0.007 | -0.006 | 0.019 | 0.019 | -0.135 | -0.014 |
| | (0.004) | (0.004) | (0.006)*** | (0.006)*** | (0.006)** | (0.006)** |
| | [0.006] | [0.006] | [0.009]** | [0.009]** | [0.010]* | [0.010]* |
| Controls | No | Yes | No | Yes | No | Yes |
| Observations | 16,050 | 16,050 | 20,970 | 20,970 | 10,307 | 10,307 |
| R-squared | 0.817 | 0.817 | 0.577 | 0.577 | 0.701 | 0.703 |

Notes: Robust Standard errors are in between parentheses. Clustered standard errors at child individual level are in between square brackets. All models include a child individual dummy, a time dummy and are estimated by OLS. Children are from 1 to 18 years old. Controls include Age, Number of people in the house, Urban area, Poverty and Household income per capita. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

**Table 5. The effects of earthquake on adults**

| | Labour participation | | Job search | | Health Problems | | Self-evaluation of health | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Impact of the shock | -0.024 | -0.008 | -0.028 | -0.027 | 0.0232 | 0.024 | -0.088 | -0.088 |
| | (0.005)*** | (0.002)*** | (0.009)*** | (0.009)*** | (0.005)*** | (0.005)*** | (0.017)*** | (0.017)*** |
| | [0.008]*** | [0.004]** | [0.012]** | [0.012]** | [0.007]*** | [0.007]*** | [0.024)*** | [0.024]*** |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes |
| Observations | 43,354 | 43,354 | 23,537 | 23,537 | 43,354 | 43,354 | 43,354 | 43,354 |
| R-squared | 0.802 | 0.964 | 0.804 | 0.805 | 0.590 | 0.591 | 0.686 | 0.686 |

Notes: Robust Standard errors are in between parentheses. Clustered standard errors at individual level are in between square brackets. All models include an adult individual dummy, a time dummy and are estimated by OLS. Adults are from 18 to 60 years old. Controls include Age, Marital status, Head of Household, Number of people in the house, Years of Schooling, Urban area, Poverty and Household income per capita. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

**Table 6. Robustness Checks: the impact of Earthquake at the Household Level**

| | Labour participation | | Job search | | Health Problems | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Impact of the shock | -0.030 | -0.030 | -0.014 | -0.014 | 0.048 | 0.049 |
| | (0.006)*** | (0.006)*** | (0.005)*** | (0.005)*** | (0.009)*** | (0.013)*** |
| | [0.009]*** | [0.009]*** | [0.007]* | [0.007]* | [0.013]*** | [0.013]*** |
| Controls | No | Yes | No | Yes | No | Yes |
| Observations | 22,118 | 22,118 | 19,054 | 19,054 | 22,118 | 22,118 |
| R-squared | 0.810 | 0.814 | 0.707 | 0.707 | 0.581 | 0.581 |

Notes: Robust Standard errors are in between parentheses. Clustered standard errors at household level are in between square brackets. All models include a household dummy, a time dummy and are estimated by OLS. Controls include Age, Number of people in the house, Urban area, Poverty and Household income per capita. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.