World Development 111 (2018) 1–12

Contents lists available at ScienceDirect

World Development

journal homepage: www.elsevier.com/locate/worlddev

Natural disasters and human capital: The case of Nepal's earthquake

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ARTICLE INFO

Article history:
Accepted 23 June 2018

JEL classification:
I30
O10
Q54

Keywords:
Natural disasters
Earthquake
Education
Difference-in-differences
Nepal

ABSTRACT

We exploit the quasi-random spatial and temporal nature of ground tremors to evaluate the long-term impact of the 1988 earthquake on educational outcomes among affected children of rural Nepal. We employ difference-in-differences research design to show that infants born in districts severely affected by the earthquake are 13.8% less likely to complete middle school and 10% less likely to complete high school. Our findings demonstrate that children belonging to high caste groups mitigate the negative environmental shock in the long run. However, infants belonging to low caste groups are 17.6% less likely to complete middle school and 11.9% less likely to complete high school. We also find that male infants exposed to a severe earthquake perform significantly better than their female counterparts, suggesting prospects of gender bias in a patriarchal society. Together, these results provide strong evidence that earthquakes lead to deterioration of human capital in a developing country setting.

1. Introduction

Recent data from the Center for Research on the Epidemiology of Disasters (CRED) demonstrate that economic damages from natural disasters have increased from US$ 246.8 billion in 2005 to US$ 366.1 billion in 2011. According to the U.S. Geological Survey (USGS), earthquakes alone have led to more than 800,000 deaths worldwide between 2000 and 2015. More specifically, Guha-Sapir, Vos, Below, and Penserre (2012) report that Asia comprised almost 40% of the global natural disaster damages and 90% of the victims worldwide between 2001 and 2010. The 2015 earthquake in Nepal is a case in point, which affected approximately 8 million people, resulting in an economic loss of US$ 10 billion, equivalent to about a half of Nepal's gross domestic product (Goda et al., 2015).

The purpose of this paper is to evaluate the impact of the 1988 earthquake on educational attainment in Nepal. On August 21, 1988, a 6.7 degree on the Richter scale earthquake killed 721 people, rendered almost half a million people homeless and demolished over 105,000 buildings in 33 districts of Nepal. Consistent with prior literature (Caruso & Miller, 2015), we take advantage of plausibly exogenous seismic intensity of the 1988 earthquake and evaluate the long-term repercussions of the natural disaster on human capital accumulation of the affected generation. According to Gupta (1988), construction practices in Nepal during an early time period of the 1980s involved inherently weak buildings. During this time period, Nepal also lacked access to well-functioning global financial markets, adequate redistribution system of aid or transfers and attractive migration opportunities. This setting offers a unique environment in which the adverse consequences of natural disasters are likely to last in the medium and long run.

In this paper, we conduct Nepal's first comprehensive empirical assessment of the long-term impact of the 1988 earthquake on human capital accumulation among infants exposed to the natural disaster at an early age. We use a rich nationwide household survey, the 2008 Nepal Labor Force Survey (NLFS), to evaluate the long-term repercussions of a major earthquake on educational outcomes in the Eastern region of Nepal. We employ difference-in-differences (DID) research design to examine the long-term educational outcomes of a sample of children who were 0–2 years old in age during the time of the earthquake in 1988. Specifically, we compare the educational outcomes of children between their districts of birth severely affected by the earthquake and those minimally affected by the earthquake, and treat older cohort that completed education and was born in districts of either type as a relevant control group. We take advantage of information on plausibly exogenous seismic intensity to determine the severity of the

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https://doi.org/10.1016/j.worlddev.2018.06.019
0305-750X/

earthquake and address the potential endogeneity of economic damages stemming from natural disasters across regions. Our educational outcomes include grades of educational attainment and completion rates of elementary school, middle school and high school.

Our empirical results indicate that infants born in districts severely affected by the earthquake complete on average 0.8 grades less schooling compared to their counterparts. Similarly, they are 13.8% less likely to complete middle school and 10% less likely to complete high school. Our findings further demonstrate that male infants exposed to a severe earthquake perform significantly better than their female counterparts, suggesting prospects of gender bias in a patriarchal society (Caruso, 2015; Neumayer & Plümper, 2007; Tan, Zhibo, & Zhang, 2015). We also find that infants belonging to low caste groups are 17.6% less likely to complete middle school and 11.9% less likely to complete high school. Strikingly, we don't observe any negative effect of the 1988 earthquake on educational attainment of children belonging to high caste groups. Together, these results provide compelling evidence that natural disasters deteriorate human capital among individuals that possess lower levels of social capital.

This paper contributes to the literature examining the long-term repercussions of a large negative shock on human capital accumulation in two important ways. First, we show that natural disasters can widen the gap in human capital accumulation between high caste and low caste households in a developing country setting. Our study offers strong evidence that high caste households recover to pre-disaster education levels quickly while low caste households do not recover at all. We interpret our estimates to suggest that the magnitude and persistence of disaster impacts might differ across household characteristics such as access to finance and social network (Carter, Little, Mogues, & Negatu, 2007; Nakamura, Dorjjadamba, & Sodnomdarjaa, 2017; Sawada & Takasaki, 2017). Although previous studies emphasize the positive aspect of natural disasters through creative destruction or institutional transition[1] at a macro level, negative impact estimates among low caste individuals suggest that such recovery channels are less likely to be prevalent in the context of Nepal. Our estimates suggest that the government needs to design awareness campaigns on natural disasters and potential preparedness programs exclusively for individuals belonging to low caste groups.

Second, this is the first study to assess the long-term impact of a large earthquake on educational attainment in South Asia using a quasi-experimental research design framework. Previous studies that explore the short-term and long-term impact of an exogenous shock on health, education and labor market outcomes have focused on countries outside of South Asia.[2] Although the entire Himalayan region is considered to be vulnerable to high-intensity earthquakes of magnitude exceeding eight degree on the Richter scale, there exists a dearth of rigorous evidence on long-term consequences of an earthquake on human capital in the context of South Asia. To our knowledge, a study by Nandi, Mazumdar, and Behrman (2018) that examines the effect of the 2001 Gujarat earthquake on reproductive outcomes is the only other empirical paper to have explored earthquakes in South Asia.

The remainder of the paper is structured as follows. Section 2 presents a detailed background on Nepal and a comprehensive overview of the earthquake in 1988. Section 3 develops an empirical model followed by data description and the main results of the study in Section 4. Finally, Section 5 discusses implications of the empirical findings and concludes.

2. Background

Nepal is a land-locked country with a total area of 147,181 square kilometers surrounded by India on three sides and China to the north. According to 2011 Population Census, the population of Nepal stands at 26.6 million (NDHS, 2012). For administrative purposes, Nepal is divided into five development regions: Eastern, Central, Western, Mid-western, and Far-western.[3] Similarly, the country is divided into 75 administrative districts, which are further divided into smaller units, called village development committees (VDCs) and municipalities (NDHS, 2012).

According to 2011 Population Census, there are 125 ethnic groups in Nepal, including Chhetris (16.6%) and Brahmins (12.2%) that belong to high caste groups. In addition, Magars, Tharus, Tamangs, Newars, Kamis, Muslims, Yadavs and Rais are some other ethnical groups classified as non-high caste groups. Nepali is widely spoken and is the first language of 44.6% of the population. Maithili and Tharu are also in wide use, though some 120 other languages are also native to Nepal. 81% of the people in Nepal practice Hinduism (NDHS, 2012).

2.1. The 1988 earthquake

A 6.7 degree on the Richter scale earthquake struck a significant portion of Nepal at 04:29:11 local time on August 21, 1988.[4] The earthquake rocked the central and eastern region of Nepal, affecting 39.57% of the total area and causing widespread damages to property and considerable loss of life (Gupta, 1988).[5] Rough estimates from the USGS show that the 1988 earthquake led to deaths of 721 people and 2,200 heads of cattle. Moreover, Gupta (1988) point out that the earthquake affected 33 districts, injured 12,244 people and demolished 105,099 buildings in the entire country. The World Health Organization (WHO) disaster preparedness document claims that hillside erosion, subsequent mudslides and floods exacerbated the impact of the earthquake and increased the death toll further. Bista (1989) explain that the disaster, followed by numerous aftershocks, devastated the economy, "rendering almost half a million people homeless and knocking down 1202 school buildings and 14 campus facilities throughout the eastern region of the country." Bista (1989) further claim that the earthquake led to unprecedented loss of property worth more than $200 million, giving rise to a "major disruption of the national economic planning efforts". The government declared September 21st, 1988 the national mourning day in memory of the earthquake victims (Gupta, 1988).

[1] The primary argument raised in these studies is that earthquake might replace old physical capital and instead promote development of new technology, leading to a path of long-run economic growth. These studies show that natural disaster does not necessarily have a negative impact on long-term economic growth and labor market outcomes (Albala-Bertrand, 1993; Cavallo, Galiani, Noy, & Pantano, 2013; Crespo Cuaresma, Hlouskova, & Obersteiner, 2008; Hallegatte & Dumas, 2009; Toya & Skidmore, 2007). While Skidmore and Toya, 2002 find that disaster risk serves to increase the relative return to human capital, duPont IV and Noy (2015) report that the 1995 Kobe (Great Hanshin-Awaji) earthquake led to a 12% decline in GDP per capita for 2008.

[2] These studies exploit rainfall shocks, extreme weather events and natural disasters such as famines, floods, wars and earthquakes to identify plausibly exogenous shock in early age (Almond, 2006; Almond, Edlund, & Palme, 2009; Almond & Currie, 2011; Ampaabeng & Tan, 2013; Caruso & Miller, 2015; Currie & Vogl, 2012; Groppo & Kraehnert, 2015; Leon, 2012; Maccini & Yang, 2008; Neelsen & Stratmann, 2011).

[3] As of 20 September 2015, Nepal is divided into 7 states and 75 districts. It has 744 local units. There are 4 metropolises, 13 sub-metropolises, 246 municipal councils and 481 village councils for official works. However, given that our analysis hinges on 2008 data, these changes are not relevant for this study.

[4] Jain, Agrawal, and Tripathi (1991) report that the epicenter of the earthquake located at a place (26.7 N°, 86.6 E) in eastern Nepal between Udaipur and Dharan, indicating focal depth of about 36 miles.

[5] According to Gupta (1988), the earthquake affected an area of approx. 55,866 square kilometers in the Nepal side. It was estimated that 66,000 houses needed reconstruction with many thousands needing repair and strengthening. Several people and families were housed in temporary shelters or in tents.