Natural Disaster, Poverty, and Development: An Introduction

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Summary. — This paper introduces the special issue, "Natural Disaster, Poverty, and Development." We examine the macro-level nexus between natural disasters and poverty, discuss prospects for formal insurance against disasters, and review the micro-development literature on informal insurance against risk. We develop a conceptual framework for microeconomic analyses on the disaster–poverty nexus, highlighting asset loss/recovery and asset-dependent private coping, disaster aid and its link with private mechanisms, and broad/persistent impacts of disasters and coping responses. We synthesize the main findings of the nine articles, revealing the critical importance of the complementarity among markets, governments, and communities for successful pro-poor disaster policies.
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1. INTRODUCTION

Natural disasters can be devastating, not only in terms of lives lost, but also for survivors' livelihoods. Several high-profile natural and man-made disasters have recently hit both developed and developing countries. The 2011 earthquake, tsunami, and nuclear radiation crisis in Japan killed tens of thousands of people and resulted in damages of around US $200 to 300 billion (Cabinet Office, 2011). Hundreds of thousands of lives were lost in the 2013 super typhoon Yolanda in the Philippines; the Indian Ocean tsunami; Hurricane Katrina in the United States; and the earthquakes in central Chile, Haiti, Sichuan Province of China, northern Pakistan, and the Hanshin area of Japan. Natural disasters, whether they occur in advanced or developing nations, destroy people's lives. Economic crises also bring lasting effects, like the global financial crisis triggered by the 2008 failure of Lehman Brothers, which slowed global economic growth with far-reaching effects similar to those of the Great Depression of the 1930s. Nations in Africa are still at war and involved in conflicts, and terrorist attacks are having serious impacts, even in advanced nations. Natural and man-made disasters show distinct trends across the globe: Natural and technological disasters have been occurring more frequently than financial crises and violence-related disasters, as measured by the average occurrence per country per year (Aldrich, Oum, & Sawada, 2014; Sawada, 2017). Many reports implicate climate change in the recent increase in hydro-meteorological natural disasters, such as cyclones, floods, and droughts (e.g., Cavallo & Noy, 2009; Kellenberg & Mobarak, 2011; Strömberg, 2007; World Bank, 2013).

Poor people living in developing areas are particularly susceptible to natural disasters (World Bank & United Nations, 2010), and vulnerability to natural disasters is a major barrier to mitigating poverty and facilitating economic development (e.g., Sawada, 2007; Skoufias, 2003). Strengthening private safety-net mechanisms and designing effective public risk management and social protection policies are critically important in protecting the poor from the adverse consequences of natural disasters over time. Put differently, better post-disaster policies could significantly contribute to permanent improvements in people's welfare (Skoufias, 2003). All of the articles in this special issue of *World Development* explore the disaster–poverty nexus.

The remainder of this paper is organized as follows. The next section uses macro data to show evidence on the disaster-poverty nexus. While the frequency and severity (measured as economic damage relative to economic size) of natural disasters are not significantly different between developing and developed countries, formal insurance mechanisms against natural disasters are more limited in poorer nations. Then, Section 3 explores prospects for formal insurance against natural disasters, focusing on index insurance as a promising new market mechanism. It becomes clear that informal insurance mechanisms can play a critical role among the poor, and to investigate their effectiveness against natural disasters, it is necessary to examine micro-level decisions and outcomes. Section 4 reviews the micro-development literature on informal insurance mechanisms against natural disasters and extreme weather events. Our goal in this section is not to provide a comprehensive review, but to present key concepts that we then use to develop an analytical framework for conducting micro-level analyses on the disaster–poverty nexus.[1] We show that as poor households can employ only limited ex-ante risk-mitigating strategies, their ex-post risk-coping strategies are critical. In Section 5, our conceptual framework highlights aspects specific to natural disasters that, in our view, have not received systematic attention: asset loss/recovery and corresponding asset-dependent private mechanisms, disaster aid and its link with private mechanisms, and broad and persistent impacts of disasters and coping responses. Section 6 uses the framework to summarize and synthesize the main findings of the nine papers included in the special issue. In

the last section, we discuss common lessons for pro-poor disaster policies.

2. DISASTER–POVERTY NEXUS—MACRO EVIDENCE

How are natural disasters related to poverty and development? To answer this question, we first employ cross-country data to quantify the relationship between the frequency of natural hazards and income level. Figure 1 displays the relationship between the natural log of a country's per-capita real GDP in 2000 and the total number of natural disasters in the 10 years from 2000 to 2009, using the semi-parametric regression method developed by Robinson (1988). In the parametric part, we control for differences in land size, because the physical size of a country is likely to be positively correlated with the frequency of disasters, especially if the probability of disaster occurrence is uniform across space; indeed, the parametric estimation result of Figure 1 yields a positive coefficient on the land-size variable. Yet, there is clearly no systematic relationship between the frequency of natural hazards and income or poverty level (as found by Kahn 2005). That is, the probability of being hit by a natural disaster is not systematically different between developing and developed countries.

In contrast, richer nations seem to suffer greater economic losses from natural disasters than poorer countries (Freeman, Keen, & Mani, 2003; Raddaz, 2007). Figure 2 confirms the positive relationship between total economic damages (2000–09) and log per-capita GDP (2000), where we control for factors determining economic damages, such as land size, population size, and population density. This relationship partly reflects the fact that the value of damaged assets is larger in richer countries even if the disaster's physical intensity is comparable across countries. [2]

To what extent are disaster damages insured? In general, formal insurance mechanisms are weak against losses caused by natural disasters (Cummins, 2006). For example, although Hurricane Katrina in the United States and the Great Hanshin Awaji Earthquake in Japan each generated economic damages of around $100 billion, the insured losses were $45 billion and $6 billion, respectively (Cummins, 2006; Sawada, 2007). This indicates that, even in the US, with a particularly well-developed private insurance market, more than half of disaster losses were uninsured. The capacities of formal insurance markets in poor nations are especially limited: The insurance market penetration ratio—the proportion of non-life insurance premium payments to GDP (based on the country panel of 2000–04)—is systematically lower in low-income countries than in high-income countries, as shown in Figure 3, where population size, individual country fixed effects, and year effects are controlled for (based on the semi-parametric regression model of Yatchew (1997)). Consistent with the previous literature on insurance, Figure 3 shows that insurance is a luxury good, i.e., the income elasticity of insurance demand is greater than unity and the relationship between insurance penetration and income level takes an S-shaped relationship (Enz, 2000; Outreville, 1990).

The limited accessibility to insurance markets involves significant welfare losses. A way to measure such losses is to calculate the amount of money households would be willing to pay to completely eliminate income variability, i.e., the Arrow–Pratt risk premium (Barro, 2009; Morduch, 1995). [3] By that measure, the estimated welfare costs of weather risks in India and Pakistan are at least 10% and can be as much as 30–50% of household income (Sawada, 2007). Since natural disasters involve larger income losses than those considered here, these estimated welfare costs should be interpreted as the lower bound estimates of those of natural disasters. Indeed, Barro (2009) finds that society would willingly reduce
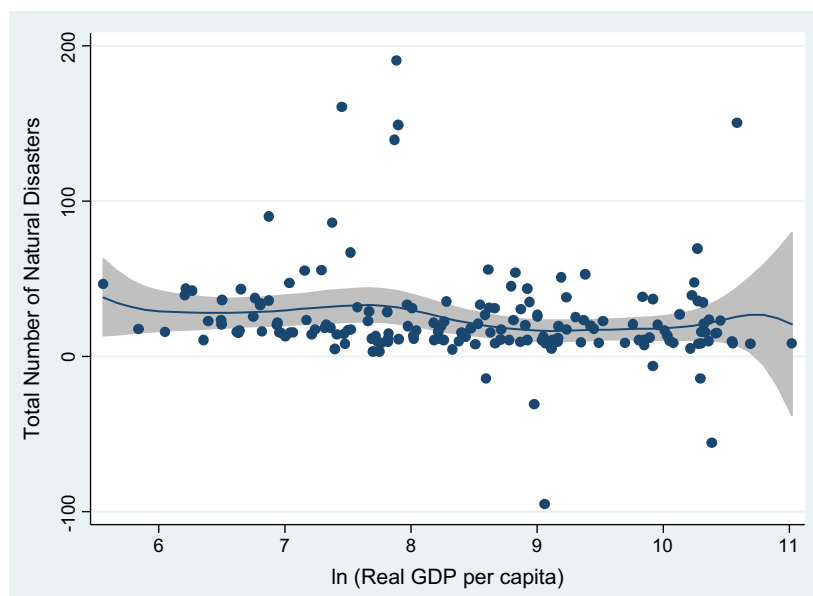

Figure 1. *Frequency of natural disasters during 2000–09 and log per-capita real GDP (US$) in 2000 across countries. Data: EM-DAT, The Center for Research on the Epidemiology of Disasters (CRED) in Belgium, and Penn World Tables Mark 7.1. Note: The figure shows the non-parametric estimation result with land size as the parametric control part. The estimate is based on the semi-parametric regression model of Robinson (1988). With the test statistic of Härdle and Mammen (1993), we cannot reject the null hypothesis that the nonparametric fit could be approximated by a linear horizontal line at a 1% significance level.*