

# Benefiting From Disaster? Public and Private Responses to the Wenchuan Earthquake

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**Summary.** — We provide the first household survey-based evidence on the impact of the 2008 Wenchuan earthquake on the welfare of rural households. Asset and income losses were substantial, especially in seriously affected areas. Our main finding is that there was an overwhelming government response to the disaster. Subsidies provided to households in 2008 were so large that mean income per capita was 17.5% higher in 2008 than in 2007 and the poverty rate actually declined from 34% to 19%. Using distance from the epicenter as an instrument for earthquake damage, we find a strong positive statistical relationship between lost value of housing and other assets due to the earthquake and increases in income per capita and government transfers received, and much weaker responsiveness of private transfers, wage labor supply, and borrowing.

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## 1. INTRODUCTION

On May 12, 2008, an earthquake registering 8.0 on the Richter scale struck western China. According to official statistics, 69,200 people were killed, 17,900 went missing, 374,643 were injured, and the value of damage was estimated to be 845 billion RMB (about 121 billion US dollars). The epicenter was in Wenchuan County, which is located in a poor, mountainous region of Sichuan Province.

China was widely praised for its rapid and massive government-led response to the disaster (Shi *et al.*, 2012). The government quickly mobilized the People's Liberation Army to assist in recovery and relief efforts, and provided subsidies, temporary shelter, food rations, and other supplies to earthquake victims. In early 2009, in response to the global economic crisis the government passed a massive 4 trillion RMB stimulus package, of which 25% (or 1 trillion RMB) went to earthquake reconstruction. In addition, richer provinces were paired with disaster-affected counties and required to put aside 1% of provincial government revenue to assist in the reconstruction work in partner counties, a massive amount of funds relative to the ordinary budgets of those counties. By the end of September 2009, China also had mobilized 79.7 billion RMB in social contributions from individuals and NGOs inside and outside of China.

Although many of these facts about China's response to the Wenchuan earthquake have been well-documented, to date no systematic evidence has been provided on how the earthquake affected individual households in disaster-affected areas. Because the earthquake occurred in a very poor region, there is particular concern that poor households were ill-equipped to cope with such a traumatic shock.

The goal of this paper is to provide the first household survey-based evaluation of the impacts of the earthquake, as well as subsequent public and private responses to the disaster, on the welfare of rural households. We accomplish this goal by analyzing data from a unique survey of households living in poor villages in earthquake-affected regions that was conducted 10 months after the earthquake which asked detailed questions about household income and assets before and after

the earthquake, as well as about changes in wage labor supply, government transfers, private transfers, and borrowing. We first present descriptive evidence on the extent of earthquake damage and changes in income (including government and private transfers), poverty, borrowing, and labor supply. We then conduct regression analysis to examine how pre-transfer income, income (including transfers), wage labor supply, government transfers, private transfers, and borrowing were affected by the value of losses due to earthquake damage. To address the potential endogeneity of earthquake damage, we use distance from the earthquake epicenter (defined by earthquake damage zone dummy variables) as an instrument for the log of the value of housing and other assets lost due to the earthquake.

We find that government assistance in 2008, the year of the earthquake, was so substantial that despite significant negative shocks to pre-transfer income caused by the earthquake, mean income per capita including transfers rose and poverty rates fell by 14% (from 32% to 18%) compared to 2007. Without public and private transfers, the poverty rate would have been 39% in 2008. The regression analysis confirms a strong positive statistical relationship between earthquake damage and increases in income per capita and government transfers received, and much weaker responsiveness of private transfers, wage labor supply, and borrowing.

This paper contributes to a large literature on risk-coping in developing countries (see, for example, Dercon, 2002; Morduch, 1995) and a much smaller literature on the impact of natural disasters on household welfare (Sawada, 2007). Aggregate economic shocks like disasters often are difficult for households to cope with because community members cannot provide sufficient assistance to each other when everyone has been adversely affected. Disasters such as earthquakes also differ from typical income shocks associated with drought or

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floods because they destroy household assets (especially housing) which can lead to much larger permanent income shocks that may have longer, more persistent impacts on household consumption levels.

Two of the only rigorous microeconomic studies of household impacts of a natural disaster are by [Sawada and Shimizutani \(2007, 2008\)](#). They found that after the Kobe earthquake, the ability of households to smooth consumption was highly imperfect ([Sawada & Shimizutani, 2007](#)). In fact, the most important form of risk coping was reducing consumption (25.0%), followed by borrowing (9.4%). Private transfers were the most commonly used risk-coping mechanism (over 50%). Only 20.4% of surveyed households reported that public transfers helped them to cope with the negative shock, and only 7.4% said it was the most important risk-coping mechanism ([Sawada & Shimizutani, 2008](#)). One limitation of these studies is that they are based entirely on subjective reports of risk-coping mechanisms used, with no direct measurements of income or consumption.

A World Bank study of poverty in Aceh (Indonesia) found that the poverty headcount rate increased from 28.4% before the tsunami to 32.6% in the year after the tsunami. Households living in high tsunami areas were 17% less likely to be poor before the tsunami (after controlling for age, gender, education, occupation, and household size) but were 44% more likely to be poor the year after the tsunami. Receiving government aid and NGO aid increased the chance of escaping poverty by 43% and 23% ([World Bank, 2008](#)). The US government's response to Hurricane Katrina was criticized for being slow in the emergency relief period, and the planning process for reconstruction efforts also was delayed; one result was a massive outmigration of the population, many of whom have not returned ([Kates, Colten, Laska, & Leatherman, 2006](#)). The Turkish government also was criticized for its poor response to a major earthquake in 1999 ([Jacoby, 2008](#)).

## 2. DATA

We draw upon data from a unique survey of 3,000 rural households living in 100 poor villages in ten counties in disaster-affected areas that was conducted less than a year after the earthquake occurred. The survey was conducted in late February 2009 just more than 10 months after the earthquake. The sampling method was designed to ensure the household sample was representative of households living in poor villages in earthquake-affected areas. The ten counties were randomly drawn from the 51 earthquake-affected counties in Sichuan, Gansu, and Shaanxi Provinces using an interval sampling method using county population as weights. Six counties in Sichuan, three counties in Gansu and one county in Shaanxi were selected. Of the ten surveyed counties, three (all in Sichuan) were classified as being seriously affected by the disaster. Within each sample county, ten villages were randomly selected from the list of nationally designated poor villages in the county using the same method. Poor village designations are based on multiple criteria determined by county and provincial governments, and qualify villages for targeted public investments for poverty alleviation financed by the central government ([Park & Wang, 2010](#)).

Within each village, 30 household were randomly sampled. Village leaders first ranked all households in the village by economic status and then households were selected using a random starting point and fixed interval. In cases of nonresponse, households were replaced with the household nearest to them on the list (just above then just below) with

this process being repeated as necessary. The survey was supervised by one of the authors with the support of national, provincial, and county government Leading Group Offices for Poverty Alleviation and Development (LGOPAD). University students from Sichuan and Gansu served as enumerators.

The survey asked retrospective questions about the household's economic conditions before and after the earthquake (in 2007 and 2008) including detailed information on income transfers from various sources. It also asked direct questions about the value of damage suffered due to the earthquake. This enables an analysis of how the earthquake and subsequent responses affected the well-being of rural households. We control for inflation by deflating all 2008 nominal values using provincial rural CPIs. A village community questionnaire was also completed based on interviews with village leaders. Means and standard deviations of all variables used in the analysis are provided in the Appendix.

## 3. DESCRIPTIVE EVIDENCE

In this section, we present descriptive evidence on the extent of damage to property caused by the earthquake, the impact of the earthquake on incomes and poverty, the magnitude of public and private transfers as well as household borrowing, and labor responses to the earthquake. In each case, we report summary statistics for the whole sample and separately for households in seriously affected areas and in less affected areas. These categories are based on official criteria used to determine the eligibility of counties to receive different levels of assistance.

[Table 1](#) presents summary information on the extent of property losses suffered by households. Property is divided into three types: cultivated land, housing, and non-housing assets (including consumer durables and fixed assets for production). For the full sample, 9.0% of households suffered damage to cultivated land, 46.4% suffered serious damage to housing, 97.6% suffered at least some damage to housing, and 38.5% suffered damage to other assets. Thus, nearly all households suffered from some damage to their property (98.1%). The share of households experiencing different types of damage was significantly greater in seriously affected areas; for example the share of households suffering from land losses, serious damage to housing, and damage to other assets was 38.1%, 71.7%, and 79.1% in seriously affected areas but only 3.9%, 35.5%, and 26.6% in less affected areas.

In terms of the value of property lost, by far the most important category was housing. This is not surprising given that housing accounts for a very high share of total household wealth in rural areas. On average, the value of lost housing value per capita was over 4,000 yuan, and in seriously affected areas it was 8,737 yuan. Damage to other assets on average was small by comparison—just less than 400 yuan overall and 1,143 yuan in seriously affected areas. The proportion of pre-earthquake assets (housing plus other assets) lost due to earthquake was 42.5% overall, 62.0% in seriously affected areas, and 26.6% in less affected areas. Thus, for many households the earthquake destroyed most of their existing property. Average asset losses were equal to about 1.6 years of average household income.

How did the earthquake affect incomes per capita? To get at this question, we compare household incomes in 2008 and 2007 based on retrospective questions on income included in the household questionnaire. Results are reported in [Table 2](#). Given that the earthquake didn't occur until May of 2008, comparing incomes in the two years could lead to

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