ADBI Working Paper Series

**NATURAL DISASTERS, PUBLIC SPENDING,
AND CREATIVE DESTRUCTION:
A CASE STUDY OF THE PHILIPPINES**

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No. 817
March 2018

Asian Development Bank Institute

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In this report, "$" refers to US dollars.

Abstract

Typhoons, floods, and other weather-related shocks can inflict suffering on local populations and create life-threatening conditions for the poor. Yet, natural disasters also present a development opportunity to upgrade capital stock, adopt new technologies, enhance the risk-resiliency of existing systems, and raise standards of living. This is akin to the "creative destruction" hypothesis coined by economist Joseph Schumpeter in 1943 to describe the process where innovation, learning, and growth promote advanced technologies as conventional technologies become outmoded. To test the hypothesis in the context of natural disasters, this paper takes the case of the Philippines—among the most vulnerable countries in the world to such disasters, especially typhoons. Using synthetic panel data regressions, the paper shows that typhoon-affected households are more likely to fall into lower income levels, although disasters can also promote economic growth. Augmenting the household data with municipal fiscal data, the analysis shows some evidence of the creative destruction effect: Municipal governments in the Philippines helped mitigate the poverty impact by allocating more fiscal resources to build local resilience while also utilizing additional funds poured in by the national government for rehabilitation and reconstruction.

Contents

1. INTRODUCTION

Hazards such as typhoons, earthquakes, and floods can turn into deadly disasters if they occur in vulnerable areas inhabited by people, especially those with few defenses (Tulloch 2010). Developing Asia is the most natural disaster-prone region in the world (ADB 2013a, ADBI 2013). The shocks expose 1.6 billion Asians who live on less than $2 a day to life-threatening conditions. The region has accounted for about one-third of the disasters worldwide over the last decade: Close to 350,000 people died and over 1.7 billion were affected. Total damages were valued at almost $500 billion. Large calamitous events can also push the region back on to a slower path of economic growth.

Such catastrophic events are increasingly being recognized as catalysts for political action and policy change (Pelling and Dill 2006). Indeed, the rising frequency and intensity of the disasters in Asia has led to a significant shift in government responses from reactive to proactive as observed in high-risk countries such as Indonesia and Viet Nam (see, for example, Gignoux and Menéndez 2016, and Noy and Vu 2010). Improved public spending and investment following a disaster can help augment and upgrade capital stock, encourage the adoption of new technologies, enhance the risk-resiliency of existing systems, and lift standards of living (Hallegatte and Dumas 2009, Skidmore and Toya 2002). This process can be compared to the notion of "creative destruction," coined by economist Joseph Schumpeter in 1943 to describe the process of continual product and process innovation, which replaces outdated production units with new ones. This creative destruction hypothesis can be applied to natural calamities that push for the replacement of destroyed and outdated capital with technologically more advanced assets.

Empirical evidence to support the hypothesis of such creative destruction effects in developing Asian countries is, however, sparse and focuses on very small fractions of affected people. One of the major reasons behind this trend is that nationwide household surveys that are commonly used to measure and examine people's well-being do not routinely collect panel data before and after natural disasters. Similarly, data on government spending for disaster prevention are not routinely collected. Since budgets are often allocated by ministries but preventive measures are usually implemented in infrastructure design and construction, it is not easy to measure prevention spending (World Bank and UN 2010).

To test the hypothesis of creative destruction, we take the case of the Philippines, one of the most disaster-prone—especially to typhoons—countries in the world. We capitalize on its extensive household survey data along with its detailed municipal finance data. To study household economic mobility following large typhoons, we apply synthetic panel estimation techniques to data from the country's Family Income and Expenditure Survey, a nationally representative cross-sectional survey that is conducted every three years. We then examine whether public spending by municipalities reduces the impact of the typhoons on household poverty.

The rest of the paper is structured as follows. Section II presents an overview of the socioeconomic impacts of the disasters that Filipinos endure. Section III elaborates on the concept of creative destruction and how it can be meaningfully applied to natural disasters. The next section assesses whether, and by how much, the poor in the Philippines experienced increases or decreases in their incomes vis-à-vis the rich when struck by a natural disaster. This is followed in Section V by an analysis of municipal government expenditures and their role in averting or mitigating the poverty impact of

typhoons. Section VI discusses various policy options to address the issues while the last section concludes.

2. SOCIOECONOMIC IMPACTS OF DISASTERS IN THE PHILIPPINES

Natural disasters can have catastrophic economic, social, and environmental impacts. Damage to infrastructure such as roads, telecommunications, and power networks and destruction of assets like machinery and livestock can severely obstruct economic activity. Human and social impacts can arise from loss of property, homelessness, and disruption of communities, compounded by death, disability, ill health, and mental trauma. Environmental damage can range from the felling of trees to the reshaping of entire landscapes. Indirect and longer-term impacts arise from the reduction of productivity, increased competition for resources, closing of businesses, and loss of livelihoods.

The chance of being hit by a natural disaster is not systematically different between developing and developed countries (Sawada and Takasaki 2017). Yet, the economic effect varies: Low-income countries usually incur disproportionately larger damages relative to their assets (Rentschler 2013). This is partly due to a higher value of damaged assets in richer countries. Likewise, post-disaster losses are larger for cities in low- and middle-income countries than in high-income countries (Hallegatte et al. 2013). The severity of impact depends not only on the nature of the disaster (i.e., type, magnitude, duration, and time of day it occurred) but also on the affected geographical area, the structure of the economy, and the characteristics of the population base. To cope with the losses, households may be forced to cut down expenditure on necessities such as food, health, and shelter.

The geographic location and diverse topography make many Asian countries disaster-prone, with the majority of such events occurring in areas near volcanoes or along coastlines. Bangladesh, Cambodia, India, Pakistan, Viet Nam, and the Philippines are particularly vulnerable countries. Bangladesh tops the list due to its exposure to floods, storm surges, cyclones, and landslides, the susceptibility of its population in areas with high levels of poverty, and its weak institutional capacity to address the problem. Its capital, Dhaka, is ranked as the most vulnerable city in the world, followed by Mumbai, Manila, Kolkata, and Bangkok, all potential high-growth centers.

The Philippines is especially prone to hydrometeorological events such as typhoons and floods, which accounted for over 80% of the natural disasters in the country during the last half-century. Its long coastlines with high concentration of people and economic activity and heavy dependence on agriculture and natural resources contribute to its high risk. Typhoons, which occur on average about 20 times per year, are the most common natural hazard that Filipinos face. The annual monsoon season causes severe flooding in many places though floods also occur due to human activity such as deforestation and encroachment of low-lying areas. The occurrence of these disasters has grown rapidly (Figure 1). Due to their uneven regularity, however, it is difficult to predict the number of typhoons that may occur in any one year (Figure 2).

**Figure 1: Average Annual Number of Significant Natural Disasters
in the Philippines, 1970–2016**
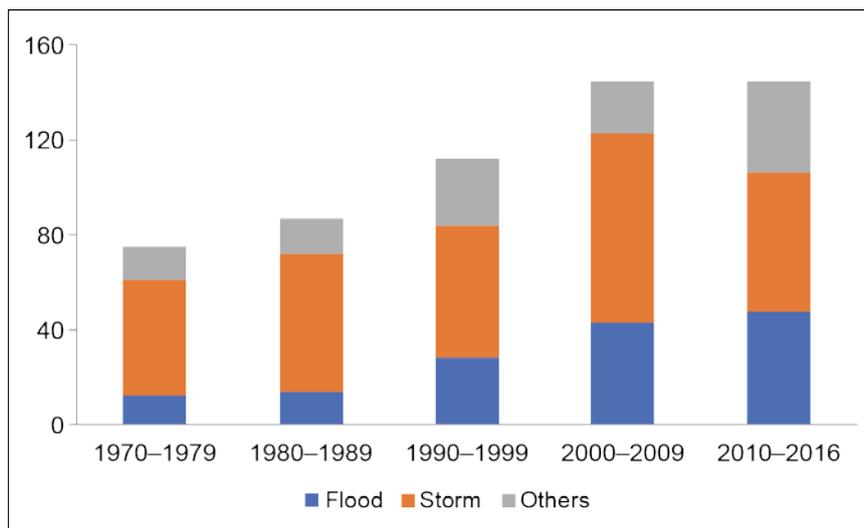
Note: Criteria of significant natural disasters: 10 or more people reported killed, 100 or more people reported affected, declaration of a state of emergency, and call for international assistance.

Source: EM-DAT: The Emergency Events Database – Université catholique de Louvain (UCL) – CRED, D. Guha-Sapir – www.emdat.be, Brussels, Belgium (accessed 8 November 2017).

**Figure 2: Growing Occurrence and Volatility of Natural Disasters
in the Philippines, 1970–2016**
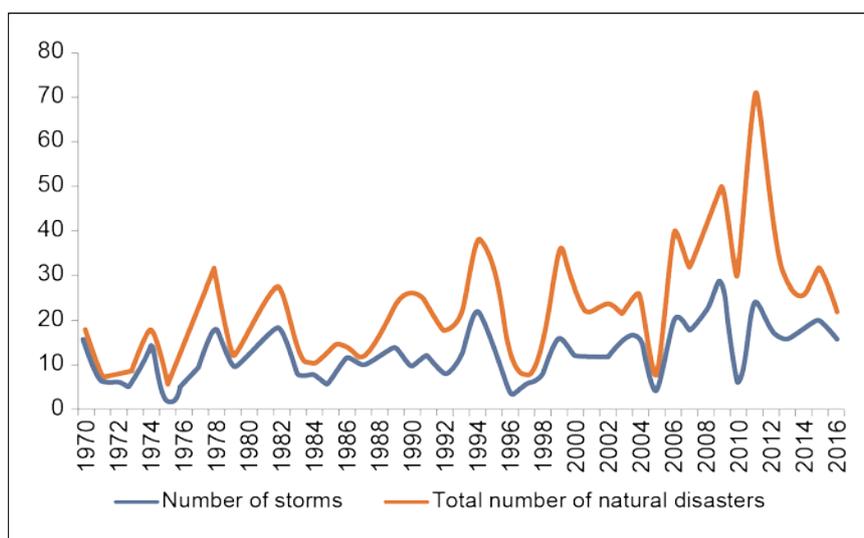
Note: Disasters covered include drought, earthquakes, epidemics, floods, mass movements (dry and wet), storms, and volcanic eruptions.

Source: EM-DAT: The Emergency Events Database – Université catholique de Louvain (UCL) – CRED, D. Guha-Sapir – www.emdat.be, Brussels, Belgium (accessed 8 November 2017).

The intensity of these events is on the rise as well: The path of typhoons has changed, tropical typhoons of weaker intensity now have very intense associated rains, and the frequency of hot days and warm nights is increasing. Thomas, Albert and Perez (2013) estimate that a rise in average precipitation deviation by 8 mm per month—as experienced in Southeast Asia in the last decade—could be associated with an additional disaster once every 3 years in the Philippines. The exposure of the

population rises with disaster intensity. Based on 25 years of Philippine typhoon data, Anttila-Hughes and Hsiang (2013) find that average losses remain high even in regions with high levels of adaptation because average exposure increases with wind speed: Marginal income losses rise by almost 3% for each 1 meter per second increase in wind speed.

Between 2000 and 2016 natural disasters in the Philippines caused over 23,000 deaths and affected roughly 125 million people (Table 1). The associated socioeconomic damage was about $20 billion with average annual damages of $1.2 billion (Figure 3). Long-term human and economic losses from typhoons in the country are much larger: Over a 25-year period, the long-term losses exceeded immediate losses by a factor of 15 (Figure 4). Such a pattern exists in other countries too. For example, even though prevention spending is more effective than post-disaster spending, World Bank and UN (2010) found prevention spending to be lower than post-disaster spending in Colombia, Indonesia, Mexico, and Nepal.

Table 1: Human Cost of Natural Disasters in the Philippines, 2000–2016

Year	Deaths	Injured	Affected (in Mn)	Cost of Damage (S Mn)
2000	748	393	6.3	90
2001	630	480	3.5	110
2002	320	233	1.2	18
2003	352	75	0.6	42
2004	1,950	1,321	3.3	139
2005	39		0.2	3
2006	2,984	2,703	8.6	347
2007	129	24	2.0	17
2008	959	1,015	8.4	481
2009	1,307	900	13.4	962
2010	1,113	124,096	5.5	335
2011	1,989	6,703	11.7	730
2012	2,415	2,879	12.5	1,006
2013	7,750	29,893	25.6	12,423
2014	331	2,269	13.3	1,063
2015	201	131	4.0	1,966
2016	87	204	5.5	180
Total	23,304.00	173,319.00	125.62	19,910.50

Note: Natural disasters covered include drought, earthquakes, epidemics, floods, mass movements (dry and wet), storms, and volcanic eruptions.

Source: EM-DAT: The Emergency Events Database – Université catholique de Louvain (UCL) – CRED, D. Guha-Sapir – www.emdat.be, Brussels, Belgium (accessed 8 November 2017)

During a difficult year, Filipino families coped by reducing spending, primarily on medicine and education, by about 25%, transport and communication by about 35%, and high-nutrient food including meat, dairy products, eggs, and fruit by about 30% (Anttila-Hughes and Hsiang 2013). Infant mortality went up, particularly among girls due to either neglect or more favorable treatment of baby boys. Similar findings are reported by Dupont et al. (2015) who estimated that the 1995 Kobe earthquake led to permanent negative socioeconomic impacts over the next 15 years. They argue for post-disaster policy making based on long-term rather than short-term

considerations. In their analysis of 89 countries, Hallegatte et al. (2017) concluded that if disasters could be prevented there would be 26 million fewer people in extreme poverty each year.

Figure 3: Total Disaster Damages in the Philippines, 2000–2016
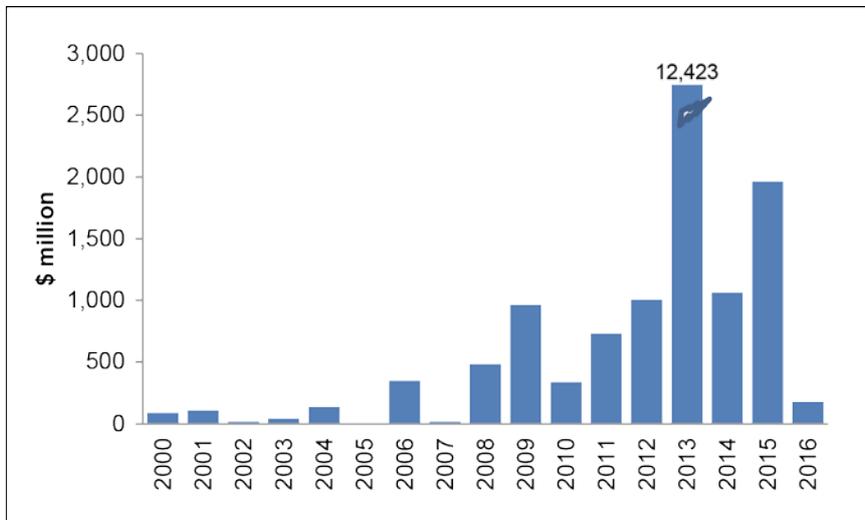
Source: EM-DAT: The Emergency Events Database – Université catholique de Louvain (UCL) – CRED, D. Guha-Sapir – www.emdat.be, Brussels, Belgium (accessed 8 November 2017).

Figure 4: Typhoons in the Philippines—Immediate versus Long-term Losses
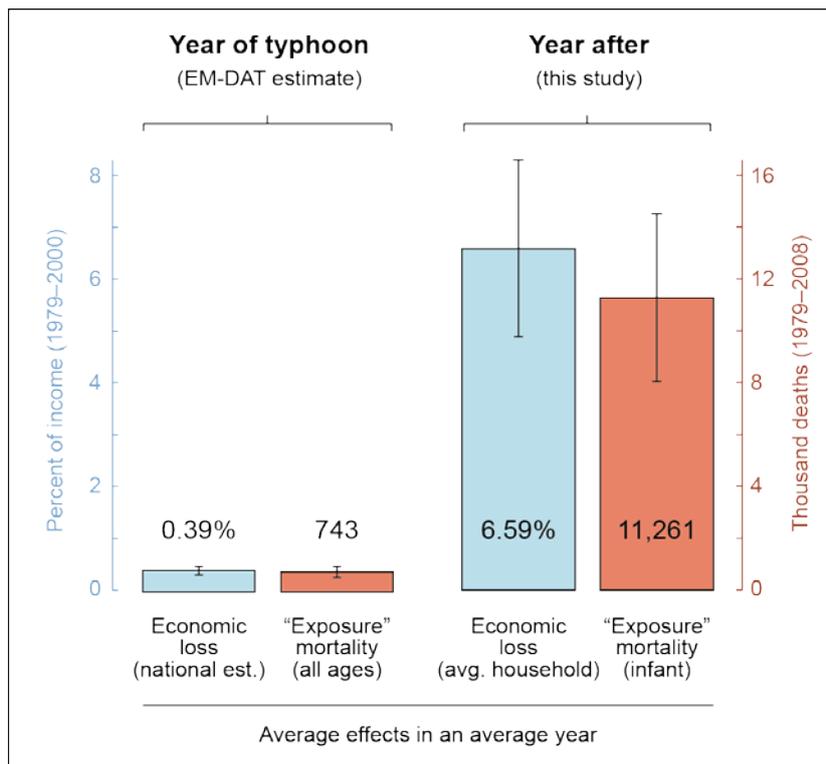
Source: Anttila-Hughes and Hsiang (2013).

3. THE "CREATIVE DESTRUCTION" EFFECT

It is hard to foresee how the trajectory of economic growth will change during and right after a disaster because there are several factors that can affect the outcome (Figure 5). The long-term growth rate may fall below the historical trend if the combined direct and indirect losses lead to a slower growth regime due to difficulties in rebuilding lost assets, infrastructure, and other capital. On the other hand, the long-term growth rate may rise above the trend if the disaster leads to rebuilding of worn-out capital or its replacement with newer and more productive technologies. If the negative effects fully offset the positive effects, there will be no long-term effect. For instance, the financial and opportunity costs of replacing obsolete capital could erode the positive effects. Based on large cross-country panel data, Loayza et al. (2012) argue that a positive growth effect may occur after moderate natural shocks but not after severe ones.

Several studies using cross-country data sources have shown a mixed effect of disasters on growth. Rasmussen (2004) finds that natural disasters lead to a median reduction of 2.2% in the same-year real GDP growth. Studies that report a negative effect include Raddatz (2007), Heger, Julca, and Paddison (2008), and Noy (2009). On the other hand, Albala-Bertrand (1993, Ch. 4) finds no or little effect. Skidmore and Toya (2002) consider average per capita GDP growth over the period 1960–1990 and find that climatic disasters are positively associated with higher long-run economic growth, while geologic disasters are negatively associated with growth.
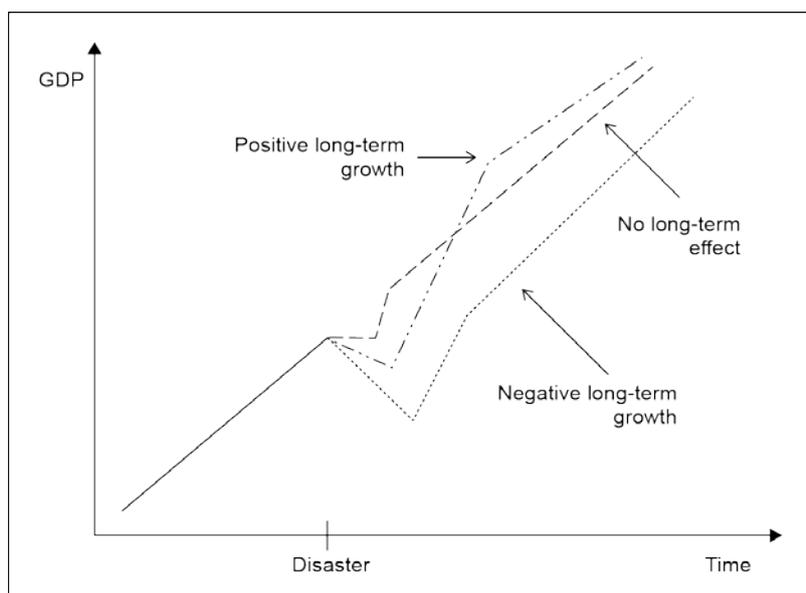
Figure 5: Impact of Disasters on Growth Prospects

Source: Insurance Bureau of Canada, 2014, Managing the risk through catastrophe insurance—reducing the fiscal and economic impacts of disasters. http://act-adapt.org/wp-content/uploads/2014/04/Economic_Impact_Disasters-Paper-2014.pdf

The "creative destruction effect" stems from the upgrading of infrastructure (e.g., construction of buildings compliant with regulatory codes or new housing with improved safety standards), and investments in better technology, which enhances productivity and creates new economic opportunities. This may happen, for example, when fresh investment costs are lower than the cost of lost capital because it is cheaper to replace than to repair damaged machinery and equipment that is inefficient or obsolete.

The government's role in supporting populations and reviving the economy by mitigating the socioeconomic impacts and speeding up recovery has been noted in some Asian countries. For example, analyzing the impact of earthquakes in Indonesia based on household panel survey data for the period 1993–2007, Gignoux and Menéndez (2016) find that while affected individuals do incur economic losses immediately following the event, rapid recovery takes place in the medium term of 2–5 years, generating income and welfare gains over a longer period of 6 to 12 years. Such mobility can be explained by the "creative destruction" hypothesis explained above. Data show that families who experienced earthquakes tend to receive more social assistance transfers in the short and medium term than those who escaped the wrath. Likewise, earthquake benefit from better road infrastructure in the long run is reflected in the reduction of time taken to reach the nearest market by 17%–22%.

Noy and Vu (2010) use provincial panel data to examine the impact of natural disasters on annual output growth in Viet Nam, which experiences frequent weather-related disasters. They find that while the shocks do reduce output growth in the aftermath, the destruction of property and capital ironically seems to boost the economy in the short run. They explain this phenomenon as arising from the reconstruction of capital stock to make it more productive, or "investment-producing destruction." However, the impact differs by geographical region due to the differential ability of the central government to make transfers to those regions.

3.1 Income Mobility of Households

The effects of disasters vary across the population. A $1 loss does not mean the same thing to a rich person and a poor person (Hallegatte et al. 2017). Disasters can thus push nonpoor households into poverty and the poor into even deeper poverty. Those at the bottom of the income pyramid will feel the maximum impact of disasters as they will have the least capacity to cope. The poor get directly hit because of their high exposure to risks inherent in the location and design of their settlements. They will also face secondary economic effects through diminished, or loss of, livelihood opportunities.

Understanding how the income mobility prospects of people who experienced a natural disaster compared with those of people who did not experience a natural disaster is instructive for testing the presence of creative destruction. Measuring income mobility traditionally required panel data sets that follow households or individuals over time. However, panel data are not readily available for most developing countries. Instead, nationally representative cross-sectional surveys are much more common and are carried out repeatedly over a long period of time. Nevertheless, there are several ways of capitalizing on repeated cross-sectional survey data to be able to measure income mobility and other indicators that were traditionally calculated using panel data. Box 1 provides a quick summary of two of the most commonly used methods for deriving pseudo or synthetic panel data. In this study, we follow the method proposed by Dang and Lanjouw (2013), which entails estimating hypothetical income for each of the survey respondents. We use the 2009 and 2012 rounds of the Philippine Family Income and Expenditure Survey (FIES) to estimate income mobility. See Box 2 for a brief description of the FIES.

Box 1: Estimating Income Mobility using Repeated Cross-sectional Data

According to Deaton (1997), panel data are not required to track the outcomes or behavior of groups of individuals over time. Using repeated cross-sectional data, pseudo or synthetic panels can be constructed to deduce behavioral relationships just as if panel data existed. Two pseudo-panel methodologies available in the literature on income mobility are those using a mean-based approach and those using a dispersion-based approach (Cruces, Fields, and Viollaz 2013). Mean-based pseudo-panels track cohorts of individuals or households over repeated cross-sectional surveys. Deaton (1995) defines a "cohort" as a group with fixed membership, individuals of which can be identified as they show up in the surveys. Unlike mean-based pseudo-panel methods that require multiple rounds of cross-sectional data to study poverty dynamics at the cohort level, dispersion-based approaches like the one used by Dang and Lanjouw (2013) construct synthetic panel data even from just two rounds of cross-sectional data. Income is estimated in the first round of cross-sectional data, using only time-invariant covariates. The resulting parameter estimates are then applied to the same time-invariant regressors in the second survey round to get an estimate of the first period's income for the households surveyed in that second round. Analysis of mobility can then be based on the actual income observed in the second round and its estimate from the first round. In this way, the synthetic household units can be considered as being followed over time.

These alternative methods offer several advantages over the panel data approach. For one, most panels suffer from attrition—the decreasing number of households being interviewed over time. Since pseudo panel data are constructed from fresh samples every time the survey is undertaken, there is no attrition. Second, cross-sectional data are more readily available than panel data. Finally, the use of pseudo panel data allows the combination of data from various surveys.

References:

Deaton, Angus. 1995. "Data and Econometric Tools for Development Economics.
         In *Handbook of Development Economics*, edited by Jere Behrman and
         T.N. Srinivasan. Amsterdam: North Holland.

Deaton, Angus. 1997. *The Analysis of Household Surveys: A Microeconomic Approach.*
         Baltimore: John Hopkins University Press.

Cruces, G., G. Fields, and M. Viollaz. 2013. Can the Limitations of Panel Datasets
         be Overcome by Using Pseudo-Panels to Estimate Income Mobility?
         http://conference.iza.org/conference_files/worldb2013/fields_g370.pdf

Dang, Hai-Anh and Peter Lanjouw. 2013. Measuring Poverty Dynamics with Synthetic
         Panels Based on Cross-Sections. https://openknowledge.worldbank.org/handle/
         10986/15863

In testing for the presence of creative destruction, we limit our analysis of natural disasters to typhoons. To be able to compare the income mobility of people who were affected by a natural disaster and those who were not affected, we consider all the typhoons in 2009 and 2012 recorded in the database of the National Disaster Risk Reduction and Management Council (NDRRMC). Using administrative data from the NDRRMC, we identify households that lived in affected municipalities. This serves as our treatment group. Our control group consists of households that were not exposed to natural disasters. Following a technique developed by Dang et al. (2014), we create synthetic panels and compare various income mobility indicators between the group of households that were affected by typhoons and those that were not. To create synthetic panels, we regress household expenditure per capita on correlates that can be considered time-invariant such as gender, ethnicity, highest educational

attainment, etc. using data from the pre-disaster (initial) time period, 2009. The resulting coefficients are then applied to the time-invariant correlates observed in the post-disaster (final) time period, 2012.

Box 2: The Philippine Family Income and Expenditure Survey

The Family Income and Expenditure Survey (FIES) is a nationwide survey of households conducted every 3 years. The Philippine Statistics Authority collects data on households using a multistage stratified random sample. As the country has 17 regions, divided into 85 provinces, the FIES sampling frame contains 1,567 geographic strata, delineated by province, urbanity, the proportion of dwellings that are permanent structures, the importance of agricultural employment, and average income. This ensures maximal representation of the population geographically, in terms of livelihoods, local government, and community income.

The FIES provides disaggregated information on household sources of income in cash and in kind and their levels of consumption by expenditure item. Related information such as family size; number of employed family members; occupation, age, and educational attainment of household head; and housing characteristics are also included.

Using a stratified sampling scheme based on the 2000 Census of Population and Housing, the survey is conducted on two occasions using the same questionnaire. The first interview is usually conducted in July of the reference year to gather data for January–June. The second interview is done in January of the following year, to account for the last 6 months (July–December). The concept of "average week" consumption is used for all food items. For expenditures on fuel, light, and water; transportation and communication; household operations; and personal care and effects, the reference period is the "past month." For all other expenditure groups and for the sources of income, the "past 6 months" is used as the reference period. All this is done to minimize memory bias and to capture the seasonality of income and expenditure patterns.

Annual data are estimated by combining the results of the first and the second visit. Estimates of income and expenditure in kind are based on prevailing market prices. The results of the survey are used to estimate the standards of living and disparities in income of Filipino families, as well as their consumption and spending patterns.

Source:

Philippine Statistics Authority. Technical Notes on the Family Income and Expenditure Survey. https://psa.gov.ph/article/technical-notes-family-income-and-expenditure-survey-fies

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The income mobility measures considered in this study fall into two categories: relative and absolute. Relative mobility measures gauge how the income of each unit in the population changes in comparison with the changes observed in other units of the population, while absolute mobility measures gauge how income levels for a unit change from one period to another (Martinez et al. 2014). To measure relative mobility, we grouped each sampled household into 20 vingtiles, based on their per capita household expenditure in a specific time period.[1] Then, we looked into movements

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[1] Often assets of households are destroyed due to disasters and they are compensated only partially. Admittedly, it would be better to compare their net worth rather than their expenditure per capita. *Net worth* is the value of all the financial and nonfinancial assets owned by an institutional unit or sector minus the value of all its outstanding liabilities. Although net worth may be a better measure, it is not completely measured in the FIES. The FIES would have a measure of the different sources of household income and expenditure but it would have an incomplete measure of the household's

from one vingtile to another over time. The metrics used are identified in Table 2. On the other hand, absolute mobility is measured by average income change and percentage income change.

A summary of the results is presented below. In terms of relative mobility, our findings suggest that households that experienced typhoons are more likely to fall into a lower income quantile than those that escaped the typhoons (Table 2). In terms of absolute mobility, we find that households that were hit by typhoons are likely to experience slower income growth than households that were not hit (Table 3).

Table 2: Relative Economic Mobility, 2009–2012

Income Mobility Indicator (2009–2012)	All HH	HH Affected by Disaster	HH Not Affected by Disaster
Average number of vingtiles moved (nondirectional)	4.561	4.356	4.874
Average number of vingtiles moved (directional)	0.160	−0.055	0.489
Proportion of population remaining in leading diagonals	0.090	0.094	0.083
Proportion of population moving one vingtile up	0.075	0.074	0.077
Proportion of population moving one vingtile down	0.074	0.079	0.065
Proportion of population moving two vingtiles up	0.065	0.065	0.066
Proportion of population moving two vingtiles down	0.064	0.068	0.058
Proportion of population moving at least three vingtiles up	0.318	0.299	0.347
Proportion of population moving at least three vingtiles down	0.315	0.322	0.304
Correlation of income ranks	0.484	0.506	0.442

HH = household.
Source: Authors' estimates.

Table 3: Absolute Economic Mobility, 2009–2012

Income Mobility Indicator	All HH	HH Affected by Disaster	HH Not Affected by Disaster
Average absolute change $|Income_{2012} - Income_{2009}|$	33,557.10	33,507.74	33,632.59
Average absolute percentage change $|Income_{2012} - Income_{2009}| / |Income_{2009}|$	1.14	1.04	1.29
Average income change $(Income_{2012} - Income_{2009})$	13,716.54	11,639.52	16,893.33
Average percentage change $(Income_{2012} - Income_{2009}) / |Income_{2009}|$	1.01	0.90	1.16

HH = household.
Source: Authors' estimates.

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financial and nonfinancial assets as well as liabilities. The FIES will be able to provide only an incomplete list of the household's durable furniture and equipment and nondurable furnishings. Purchase or amortization of real property, payments of cash loans, installments on appliances, loans granted to persons outside the household, amounts deposited in banks or investments and major repair or construction of house are all lumped into "other disbursements."

These patterns are intuitive in the sense that typhoons are generally perceived to have an adverse socioeconomic impact on income flows. However, the list of areas affected by typhoons is not random, i.e., those who were affected have systematically different characteristics than those who were not affected. Poverty and geographic location are two potential confounding factors that may influence the results. The southern Philippines, where significant pockets of income poverty exist, generally experiences fewer typhoons than the more prosperous northern and central parts of the country. Further, poor and nonpoor households have systematically different economic mobility prospects. By deriving counterfactual distributions, we can correct for the "nonrandomness" of the propensity to experience typhoons.

To control for these confounding factors, we explore two hypothetical scenarios by estimating the same set of economic mobility measures based on the following assumptions: (i) all households were affected by typhoons, and (ii) no household was affected by typhoons. To accomplish this, we first regress the household expenditure per capita in 2012 of households that were affected by typhoons and apply the resulting coefficients to all other households (who were not affected) to predict the latter's hypothetical expenditure per capita in 2012 if they too were to be affected. Analogously, we regress the household expenditure per capita in 2012 of households that were not affected by typhoons and use the resulting coefficients to predict the hypothetical expenditure per capita of all other households (that were indeed affected) under the assumption of the latter not having been affected. This approach yields more reliable control and treatment groups.

Tables 4 and 5 summarize the results. Contrary to what we observed earlier, the results provide a hint of evidence of the creative destruction effect. The estimated income growth between 2009 and 2012 is higher under the assumption that all households experienced typhoons than the estimate under the assumption that no households experienced typhoons. Figure 6 compares the income growth of households from different income deciles. Based on this mobility indicator, we find evidence of the creative destruction effect for most income groups. Interestingly, the income growth is the most pronounced for the poorest 20% of households, suggesting that this group is specifically targeted for government relief.

Table 4: Relative Economic Mobility under Hypothetical Scenarios, 2009–2012

Income Mobility Indicator (2009–2012)	All HH Affected by Disaster	All HH Not Affected by Disaster
Average number of vingtiles moved (nondirectional)	1.136	0.737
Average number of vingtiles moved (directional)	0.001	–0.003
Proportion of population remaining in leading diagonals	0.361	0.471
Proportion of population moving one vingtile up	0.153	0.199
Proportion of population moving one vingtile down	0.196	0.196
Proportion of population moving two vingtiles up	0.064	0.031
Proportion of population moving two vingtiles down	0.083	0.070
Proportion of population moving at least three vingtiles up	0.080	0.022
Proportion of population moving at least three vingtiles down	0.063	0.011
Correlation of income ranks	0.967	0.983

HH = household.

Source: Authors' estimates.

Table 5: Absolute Economic Mobility under Hypothetical Scenarios, 2009–2012

Income Mobility Indicator	All HH Affected by Disaster	All HH Not Affected by Disaster
Average absolute change $|Income_{2012} - Income_{2009}|$	9,418.91	5,653.85
Average absolute percentage change $|Income_{2012} - Income_{2009}| / |Income_{2009}|$	0.23	−0.08
Average income change $(Income_{2012} - Income_{2009})$	9,284.77	5,470.66
Average percentage change $(Income_{2012} - Income_{2009}) / |Income_{2009}|$	0.23	−0.08

HH = household.

Source: Authors' estimates.

Figure 6: Average Percentage Change in Per Capita Household Expenditure, by Expenditure Decile
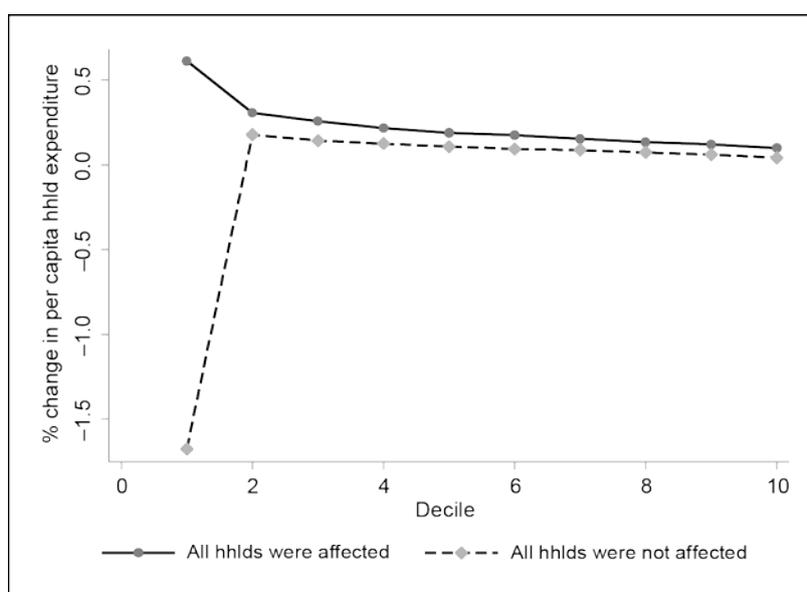
Source: Authors' estimates.

However, whether this finding is indicative that weather shocks in the Philippines do result in relief and reconstruction measures targeted at the poorest sections of the country is still subject to further scrutiny for several reasons. First, it could be the case that because low-income people have the least amount of resources, their purchasing levels may need to return to the baseline or even exceed the baseline more quickly. Second, the average income growth of the poorest 20% of households under the assumption that all households were hit by typhoons is not statistically different from the average income growth under the assumption that no households were affected by typhoons. On the other hand, we observe significant differences between the two hypothetical scenarios for other income groups, which could indicate that there is stronger evidence of creative destruction among higher-income groups. Moreover, the methodological approach used to test the presence of creative destruction is not without limitations. Box 3 describes the potential issues and offers an alternative method. Based on this alternative, we find weaker evidence to support the presence of creative destruction.

Box 3: Alternative Method of Testing the Presence of Creative Destruction

It is important to note that the counterfactual approach used to derive these estimates has several limitations that are worth mentioning. First, it is hard to gauge the statistical significance of the observed difference between the estimates derived for the two hypothetical scenarios because they are subject to two sets of model errors (i.e., errors arising from the synthetic estimation of longitudinal incomes and errors arising from the model used to create hypothetical scenarios). Second, currently, households are categorized into two groups only (whether they belong in areas that were affected by typhoons or not) and no distinction is made according to how frequently they have experienced typhoons or the amount of damage from typhoons in a specific area. Third, by applying the coefficients of the income model for households that were not affected by typhoons to impute the hypothetical incomes of households that were affected by typhoons, we are implicitly assuming that the typhoon-affected areas will necessarily have better institutions right after the disaster.

An alternative approach is to simply examine the first set of income mobility estimates by geographic location. The box table below summarizes the results. Here, the evidence for creative destruction is slightly weaker because only a few regions show some hints of creative destruction.

Geographic Region –	Average Income Change		Average Percentage Change	
	HH Affected by Disaster	HH Not Affected by Disaster	HH Affected by Disaster	HH Not Affected by Disaster
NCR	–9,415.93	–9,923.26	0.22	0.23
CAR	19,148.17	16,095.25	0.90	1.11
I – Ilocos Region	25,132.87	22,375.04	1.21	1.10
II – Cagayan Valley	18,560.60	19,352.37	0.96	1.06
III – Central Luzon	8,449.26	8,704.28	0.61	0.54
IVa – CALABARZON	–394.54		0.38	
IVb – MIMAROPA	23,140.00		1.40	
V – Bicol Region	25,511.68	24,162.50	1.55	1.44
VI – Western Visayas	24,000.72	18,966.50	1.45	1.08
VII – Central Visayas	22,811.74	14,325.50	1.63	1.12
VIII – Eastern Visayas	17,519.26	13,079.19	1.20	1.00
IX – Zamboanga Peninsula	25,427.51	13,853.84	1.99	1.02
X – Northern Mindanao	19,149.35	14,083.01	1.12	1.12
XI – Davao Region	22,805.29	15,550.70	1.76	1.03
XII – SOCCSKSARGEN	51,434.53	42,663.94	2.65	2.15
ARMM	26,937.68	27,536.67	1.58	1.75
Caraga	39,110.22	35,284.38	2.34	2.07

Source: Authors' estimates.

In other countries, there is also mixed evidence on whether or not natural disasters' long-term impacts affect the poor any differently than the higher echelons of society (Karim and Noy 2015). Intuitively, one would expect prior economic conditions to influence how one copes with natural disasters. Thus, we would expect households with higher economic status to have better post-disaster outcomes. However, post-disaster outcome is not only a function of prior economic conditions, it could also be shaped by transfers from outside the household. In other words, whether the measures to bring about such effects are self-funded by the people or reflect aid and additional government resources is a separate question. We turn to this question, in the context of the Philippines, in the next section.

3.2 Foreign Aid, Fiscal Transfers, and Municipal Spending

How can the positive effect of disasters on economic mobility be explained? Researchers often attribute the effect to the government's proactive growth-stimulating post-disaster recovery and reconstruction programs. On the other hand, given the large scale of the resources channeled to affected regions from both domestic and external sources in the aftermath of major disasters, the most important question facing a country is where the aid money is going. Global experience (Keefer 2009) shows that at the time of major disasters, countries with weak institutions often see large relief funding mismanaged or captured by local elites, with the poor and the most vulnerable population left to fend for themselves, pushing many households into deeper poverty.

In the case of the Philippines, to mitigate the continuing hazards caused by 1991's Mt Pinatubo eruption, in 2012 the Japan Bank of international Cooperation provided a concessionary loan of Php 1.32 billion to the province of Pampanga, which is about 1% of the province's GDP when combined with the government's matching fund of Php 289 million (Jose 2012). Similarly, the government prioritized public spending on disaster risk reduction investment by integrating natural disaster risk into its overall development plan, strengthening risk management institutions, and investing in early warning systems, weather forecasting, and effective disaster response systems (World Bank 2014).

Although Filipinos try to mitigate disaster impact through evacuation, temporary migration, and other coping strategies, few are prepared for super typhoons or several typhoons in succession. The sudden need for additional financing from government budgets can pose a major problem for fiscal sustainability. We use municipal-level data to examine the role of public spending as a disaster response in the country. Our aim is to examine whether extra resources channeled to disaster-hit regions for recovery and reconstruction help reduce the poverty impact. First, using the small area estimation technique, we examine the relationship between poverty and municipal fiscal resources by regressing the municipal-level poverty estimates (compiled by the Philippine Statistics Authority) on different sources of a municipality's per capita income and its various types of expenditures. The data used are for the years 2010–2015 and for all cities and municipalities that existed during this period. The population size served and other socioeconomic characteristics of municipalities as recorded from the village module of the Census of Population and Housing are used as controls. For cities, we have additional information about competitiveness that can be used as control factors too. Thus, the regression model is estimated using two specifications—one for all municipalities including cities (Model 1) and another one for cities only (Model 2). The results from Model 2 show most of the explanatory variables to be statistically insignificant (Table 6). However, the results from Model 1 provide deeper insights by pointing to a reduction in household poverty due to specific components of fiscal spending and higher local government income, after controlling for population size, the frequency of typhoons, and other socioeconomic characteristics of the municipalities. The following discussion is based on Model 1.

Table 6: Correlates of Municipal Poverty Rates

Variable	Model 1 (All Municipalities and Cities)	Model 2 (All Cities)
1. Expenditure on general public services	−0.002813	0.0010223
2. Expenditure on education, culture, and sports/manpower development	0.03712	0.010748
3. Expenditure on health, nutrition, and population control	−.082555***	−0.003983
4. Expenditure on labor and employment	0.70192	0.50455
5. Expenditure on housing and community development	−0.0025249	0.0048043
6. Social services and social welfare expenditure	−0.069358	−.094184**
7. Expenditure on economic services	0.027791	0.014189
8. Debt service (interest expense and other charges)	0.08847	−0.015462
9. Total local sources	0.0074402	0.0011419
10. Total tax revenue	.20721*	0.021305
11. Real property tax revenue	−.21438*	−0.025054
12. Tax on business revenue	−.20354*	−0.021451
13. Income from regulatory fees (permits and licenses)	−.12631*	−0.029441
14. Income from service/user charges (service income)	−0.044655	−0.024427
15. Receipts from economic enterprises (business income)	−.050712*	−0.018076
16. Internal revenue allotment	0.012329	0.0025802
17. Other shares from national tax collection	−.043368**	−0.034021
18. Inter-local transfers	−0.014609	0.010315
19. Extraordinary receipts/grants/donations/aids	−0.029608	0.074235
20. Proportion of *barangays* in the municipality with large commercial enterprises	−11.458	3.0728
21. Proportion of *barangays* in the municipality with large manufacturing enterprises	−45.393***	−9.3331
22. Proportion of *barangays* in the municipality that are predominantly dependent on the agriculture sector	15.38***	27.178***
23. Population size	−.000040563***	−0.000010011
24. 1 if doesn't experience any typhoon		
25. 1 if rarely experiences typhoons	7.7108***	6.6633*
26. 1 if frequently experiences typhoons	−10.266***	1.1778
27. 1 if very frequently experiences typhoons	−14.423***	0.27434
28. 1 if city	−5.2694**	
29. Overall competitiveness score		1.0137
30. Economic dynamism score		−0.31872
31. Government efficiency score		−1.7688**
32. Intercept	29.047***	5.142
33. Number of observations	1,599	118
34. Adjusted R^2	0.36138	0.60112

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%.
Source: Authors' estimates.

Poverty declines in municipalities regularly hit by typhoons (variables 25–27, Table 6). While post-disaster foreign aid (variable 19) is not seen as being effective in reducing poverty, [2] additional funds from higher-level governments (variable 17) allocated

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[2] It is possible that foreign aid impacts specific sectors that it may be tied to. Some effects may occur over a long period. The timing of the flow of funds may also matter. For example, Cas (2016) examines the education attainment impact of a bilateral education assistance program on the Philippines, 10 years after its launch following two super typhoons in 1987. The program, which constructed typhoon-resistant

to affected local units do have an impact. More interestingly, a greater effort by municipalities in revenue collection from taxes on property and businesses as well as user fees (variables 11–15) in the wake of natural disasters provides extra resources for fighting poverty. Municipalities with a higher proportion of *barangays* (administrative units) that host large manufacturing enterprises are at an advantage (variable 21). In contrast, deprived of a large tax base, municipalities with a higher proportion of *barangays* that are predominantly dependent on agriculture (variable 22) end up with higher levels of poverty following typhoons.

Although the results described above suggest that allocation of additional fiscal resources does cut poverty, it is possible that the effect differs depending on the rate of occurrence of natural disasters. Figure 7 illustrates this point. Among the poorest 20% of municipalities (quintile 1), the level of local fiscal expenditure per person is highest for municipalities that experienced typhoons most frequently (numbering 5–6 typhoons per year on average). Two factors may explain this phenomenon: larger transfers from higher-level governments and higher allocation of local resources, perhaps owing to early preparedness in dealing with the events since typhoons frequently strike those municipalities.

**Figure 7: Total Municipal Expenditure Per Capita by Poorest 20%
of Municipalities, 2010–2015**
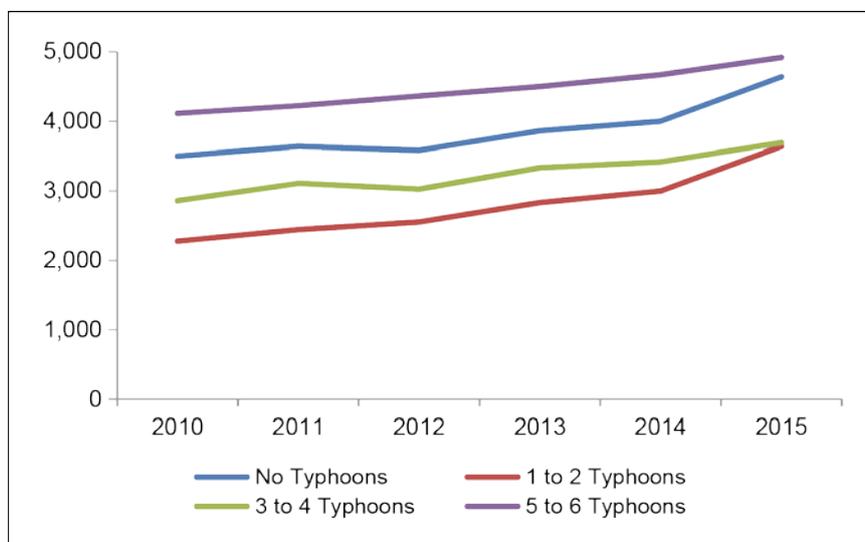
Source: Authors' estimates.

At the other extreme, municipalities that do not experience any typhoons at all do not need to divert resources for rehabilitation and reconstruction. As such, they can provide public services with similar levels of per capita expenditure as the most impacted municipalities referred to above. However, municipalities in between—those that are hit fewer times, on average by one to four typhoons per year—are perhaps not prepared to ramp up their resources for the shock as reflected in their relatively lower per capita expenditures. This could potentially suggest that even among the poorest municipalities, "creative destruction" is more likely to happen in areas that have higher exposure to natural disasters.

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schools at the municipal level and provided high school instruction material, increased the number of years of schooling for both boys and girls.

Apart from funding, another reason why the municipalities most hit by natural disasters did better than others could be the support provided by the National Community Driven Development (NCDD) program of the Department of Social Welfare and Development. This program operates in the poorest municipalities with a network of community facilitators and volunteers. When disasters strike, NCDD supports the poor beneficiaries to recover by adjusting and simplifying procedures. Following some lessons learned in response to the calamities brought about by Typhoon Yolanda, the government has strengthened the role of local government units and delineated the tasks assigned to NCDD and other government arms for efficient delivery of rescue and rehabilitation assistance (Box 4).

Box 4: Post-Yolanda Reforms in the Government Disaster Response Mechanisms

Since Typhoon Yolanda struck the Visayas region on 8 November 2013, national government agencies, local government units, the private sector, and the international community have been working together to meet post-disaster needs. According to the post-disaster needs assessment coordinated by the Office of Civil Defense, the estimated cost of damage reached ₱89.6 billion ($2.1 billion) and losses amounted to ₱42.8 billion ($1 billion).

To unify the efforts of government and other agencies involved in the rehabilitation, recovery, and reconstruction of Yolanda-affected areas, an Office of the Presidential Assistant for Rehabilitation and Recovery (OPARR) was established. OPARR led the preparation of the Comprehensive Rehabilitation and Recovery Plan (CRRP), which details the overall strategic vision and integrated short-term, medium-term, and long-term plans and programs for Yolanda-affected areas. It also established five government clusters to facilitate the streamlined and integrated planning, implementation, and monitoring of programs, projects, and activities (PPAs) at the national level:

- infrastructure (cluster head: Department of Public Works and Highways);
- resettlement (cluster head: Housing and Urban Development Coordinating Council);
- social services (cluster head: Department of Social Welfare and Development);
- livelihood (cluster head: Department of Trade and Industry); and
- support (cluster heads: Department of Budget and Management and National Economic and Development Authority [NEDA])

These five clusters in coordination with the local government units provide support to the CRRP. After the resignation of the head of OPARR, the Director-General of NEDA was tasked to undertake the coordination, monitoring, and evaluation of all disaster-related programs, projects, and activities (PPAs) for the areas worst affected by Typhoon Yolanda. NEDA retained and utilized the existing cluster structure established by OPARR to monitor and assess the status of, and address the remaining policy issues related to, the rehabilitation and recovery efforts in the affected areas.

Sources:

NEDA. 2017. Yolanda Rehabilitation and Recovery Efforts. http://yolanda.neda.gov.ph/ yolanda-rehabilitation-and-recovery-efforts/

NEDA. 2013. Reconstruction Assistance on Yolanda: Implementation for Results. http://yolanda.neda.gov.ph/ray-implementation-for-results/

World Bank. 2017. Philippines: Lessons Learned from Yolanda – An Assessment of the Post-Yolanda Short and Medium-Term Recovery and Rehabilitation Interventions of the Government. https://openknowledge.worldbank.org/handle/10986/28540

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4. POLICY IMPLICATIONS

Policy choices to respond to natural disasters should be based on the country's geography, economic and social context, and political background since these factors influence the impact of disasters. The impact also depends on the local capacity in disaster risk management, both for prevention and post-disaster recovery. Rich countries have the resources to prevent and prepare for natural shocks. An analysis of EM-DAT data shows how income levels give them the capacity to limit the death toll from disasters: From 1997 to 2016, on average more than three times as many people died per disaster in low-income countries as in high-income countries.[3] The Netherlands, for example, which is geographically prone to natural disasters, offers an interesting contrast. In terms of exposure to extreme events, it ranks twelfth on average for the period 2012–2016 on the World Risk Index (Bündnis Entwicklung Hilft 2017).[4] But its high socioeconomic, political, and institutional development allows it to reduce vulnerability, and thus its overall risk rank to 50.

Likewise, since poor households have lower capacity and fewer assets, they have a hard time coping with, and recovering from, their losses. Lacking financial and social support structures to pull themselves out of this predicament, they pass on their losses to the next generation and so the cycle of poverty continues. By contrast, rich households have the means and resources to move away from areas facing natural disasters or to protect themselves and minimize the damage that disasters can bring upon them. Rich survivors will usually have insurance to cover their medical treatment and the destruction and loss of property. The rich who perish will probably have life insurance to leave to their families so that the next generation will also be secure. As developing Asia houses the largest proportion of the world's poor, the question arises as to how Asian countries should effectively cope with natural disasters.

4.1 Preparing for Natural Disasters

Since natural disasters will continue to happen and are becoming more frequent because of climate change, urbanization, and demographic changes, building the resilience of the people is important (Hallegatte et al. 2017). Resilience measures are based on the belief that the disasters will have an impact on the community and therefore measures must be in place to facilitate a quick return to normalcy. These include community emergency response teams, temporary shelter and evacuation areas, backup generators to restore power for critical systems, credit expansion to ease credit constraints, and provision of subsidies targeted at the poor and vulnerable populations. In times of crisis, social capital can also help communities to cope. Usamah et al. (2014) found that a strong social relationship supports the strong perception and level of resilience of the communities.

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[3] However, in the face of extreme events such as Katrina, Tohoku, and Sandy, preparations even by advanced economies may not be adequate.

[4] The World Risk Index presented in the World Risk Report of the United Nations University Institute of Environment and Human Security captures not only the risk due to geographical exposure but also the ability of a country to respond, based on measures of its vulnerability in terms of susceptibility (structural, economic, and social conditions), coping capacity (ability to prevent and/or reduce disaster impact), and adaptive capacity (ability to address vulnerability in the long run and effect change in the society).

The capacity of households, businesses, and local communities to recover and restore livelihoods depends critically on the efficiency and effectiveness of post-disaster recovery and reconstruction efforts led by central and local governments. Ballesteros and Domingo (2015) emphasized the need for harmony and strong cooperation among the public sector (both local and national governments), the private sector, and the local communities to enhance business continuity and resiliency. Using a multidisciplinary perspective on risk management strategies and societal and communal resilience, Aldrich, Sawada, and Oum (2015) argue for a holistic approach to disaster recovery and mitigation. They recommend a sensible combination of community-level networks, private market mechanisms, and state-based assistance strategies in handling disasters.

Preparedness through the adoption of risk mitigation and management practices before a disaster strikes is critical. Recognizing that natural disasters compromise development, governments must take a comprehensive approach to disasters by shifting the focus from reactive actions of disaster response and recovery to the more proactive actions of risk reduction, preparedness, and mitigation. The focus should be on removing the underlying causes of vulnerability rather than on minimizing the consequences of vulnerability (ADBI 2013). A bottom-up approach involving constant dialogue with communities, especially those living in risk-prone areas, is important to make them fully aware of the hazards they are exposed to and how they can best prepare for, and cope with, them. Constant communication with the people will increase their awareness and desire to seek information, reduce rumors, influence evacuation behavior, and facilitate proper intervention. It is also important to complement these practices with improved governance.

Bangladesh, Indonesia, and Pakistan provide good examples of preventive measures (ADB 2013b). By setting up community-led early warning systems (based on volunteers with bicycles and megaphones, and text message alerts), public awareness campaigns, and communal facilities, Bangladesh has significantly reduced the number of deaths in the annual onslaught of tropical cyclones. After the 2004 earthquake and tsunami, Indonesia laid the groundwork for a much more effective disaster response by decentralizing the reconstruction agency away from Jakarta to improve disaster coordination in the archipelago. In Pakistan, following a succession of calamitous events including the 2005 earthquake, the government created a federally coordinated disaster risk system and integrated risk reduction plan.

Disaster resistance is a long-term process built through mitigation and preparedness activities coupled with actions that include revenue diversification to make people's income less vulnerable to local shocks, financial inclusion to protect their savings, health insurance, disaster risk insurance to protect people against shocks, adaptive social protection to provide affected people with timely post-disaster support, and disaster risk financing instruments to ensure that governments and local authorities have the resources to act in times of crisis (Green 2008, Hallegatte et al. 2017).[5] These activities should be sustained even with the change of political administrations because disasters do not time their occurrence based on who is currently in power. Only a sustained, long-term effort, maintained and carried through even when there are no disasters, can provide true resistance and resilience.

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[5] However, insurance programs to protect life and property may fail when large numbers of clients are simultaneously affected by a disaster, as is well known from the literature on crop insurance in agriculture.

4.2 Mitigating the Fiscal Risk

While it is difficult to predict the precise scale, time, or location of disasters, data from previous disasters can be used to anticipate aggregate annual losses nationally. Since natural disasters affect both government expenditure and revenue, proper planning and management are needed to allocate the limited resources wisely to contain the fiscal risk. Analyzing data from 22 developed and 20 developing countries over the period 1990–2005, Noy and Nualsri (2011) find that following large natural catastrophes, fiscal behavior is countercyclical in advanced economies but procyclical in developing economies. Such fiscal dynamics in low- and middle-income countries suggest an urgent need to develop insurance mechanisms that will enable governments to insure against adverse fiscal consequences.

The fiscal risk from natural disasters could be reduced by establishing a special contingency fund through budgeted allocations by the central government for a ready disaster response. For events in which the actual losses exceed the fund, the government could transfer part of the risk to reinsurance companies, which would provide a credit facility against an annual premium to cover the excess cost beyond the budgeted amount of the fund. This type of advanced preparation for funding relief and reconstruction would be more efficient and less disruptive than ad hoc disaster response.

While financial help for victims is popular with both the media and the public, it can cause a moral hazard problem as the expectation of financial assistance becomes a disincentive for private preparedness against future disasters (Ma 2011). The government should therefore use fiscal policy to direct resources towards the prevention and mitigation of disasters. Furthermore, the private sector will not adequately supply goods with positive externalities as private benefits may fall short of social benefits. Therefore, the government as the provider of public goods should also redirect spending towards cleanup efforts and reconstruction of public infrastructure following a disaster.

Building resilience requires extensive investment in municipal infrastructure and services that can help increase productivity and reduce household impacts. Specific activities such as regular training, capacity-building programs, and awareness-raising programs need to be budgeted for properly at the local level. It is therefore essential to enhance the capacity of local authorities for strategic planning, procurement, and financial management, as well as technical and operational oversight.

Developing countries usually lack the human capacity and financial resources needed for reconstruction and quick recovery. To cope with disasters, governments may have to reallocate resources from development activities to relief and reconstruction. Faced with the daunting task of recovery and reconstruction, small, resource-poor, and landlocked economies may have to rely on foreign aid, thereby increasing their risk of external indebtedness and reduced growth. Large, poor economies, in which selected areas are prone to disasters, may have to transfer resources from relatively unaffected or better-off regions, thereby affecting the growth of those areas as well. The problem may be compounded in countries with a fiscal federal structure (Box 5).

**Box 5: Dealing with Natural Disasters in Countries
with a Fiscal Federal System of Governance**

In countries with decentralized governance, natural disasters present at least two challenges to subnational governments. First, local governments are in a better position to assess the strength of infrastructure needed to withstand natural disasters—such as *ex ante* preparations, establishment and enforcement of land use, building codes, and other regulations. Second, the majority of reconstruction and reestablishing services are the responsibility of local governments, but with limited capacity and weak institutions, the local government response is often inadequate. Moreover, local bodies may freeride on the provisions from an adjacent region if that locality is damaged more than their own. For example, infrastructure to prevent flooding from sea surges cannot be assigned to single municipalities along the coast, but rather to a coastal authority, or to an intermediate level of government, whose geographical area encompasses all sea-facing areas prone to flooding.

One possible solution to the problem of moral hazard would be for the central government to assume full responsibility for disaster avoidance and preparedness, assuming control of economic development and land use policies. However, recentralizing responsibilities for all disaster avoidance policies would reduce the efficiency gains from decentralized local policymaking.

The second solution lies in the establishment of adequate coordinating institutions. Vertical and horizontal coordination between central and subnational governments assigned the responsibility to set up local disaster contingency reserves and appropriate allocation of resources would be useful in harboring efficiency gains from decentralized policymaking, while internalizing externalities from events that affect contiguous administrative regions.

A third suggestion comes from private insurance. Mandatory coinsurance would mean that the central government mandates the establishment of disaster contingency reserves ("rainy day" funds) by local governments. Under this option, each local government would be required to contribute to a fund from which it would receive disaster relief in the event of a disaster. This scheme would help finance central government reconstruction transfers and spread the burden more equitably among local governments.

Source:

Brosio, G. 2015. Improving Service Delivery through Decentralization. *Governance in Developing Asia.* Anil Deolalikar, Shikha Jha, and Pilipinas Quising (editors). UK: Edward Elgar Publishing. 180–207.

By providing implicit insurance against nature's shocks, good governance can reduce disaster risks (Ahrens and Rudolph 2006, Castanos and Lomnitz 2008, UNISDR 2011a, Wisner et al. 2004). In the Philippines, Ballesteros and Domingo (2015) note that there are sufficient legislative provisions to support a proactive response to disaster events (both for businesses and communities), but gaps in policy execution exist. Many developing countries need responsive, accountable, transparent, and efficient governance structures in disaster risk management (Davis 2011, UNDP 2010). Investment in mitigation measures such as national disaster risk assessment, early warning systems, and construction code and zoning regulations is inherently in the nature of public goods and the adequacy of their provision and enforcement is driven by government incentives and the quality of institutions (Besley and Burgess 2002, Drèze 1991, Sen 1984, World Bank and UN 2010).

Using data from 73 countries from 1980 to 2002, Kahn (2005) finds that countries with higher-quality institutions suffer fewer deaths than those with weaker institutions. Pelling and Dill (2006) note that political leaders in both democratic and authoritarian regimes manipulate disaster recovery to enhance their popular legitimacy and extend

their influence over development policies and programs. Part of good governance is the reduction or removal of corruption. According to a study, 83% of all deaths from building collapses in earthquakes over the past 30 years occurred in countries that are assessed as "corrupt" by Transparency International (ADBI 2013). When the state fails to provide necessary assistance during disasters, local associations and nongovernmental organizations (NGOs) may step in to fill this gap.

5. SUMMARY AND CONCLUDING REMARKS

High population densities in hazardous areas increase the pressure on natural resources and the environment, and raise the risk of natural disasters associated with human activity. A country is highly vulnerable to natural disasters when it does not have the means or ability to withstand the shock, for example through high-quality infrastructure. For developing countries, existing socioeconomic and political conditions can also exacerbate their vulnerability. For example, weak institutions or high levels of corruption leave buildings below required standards and essential public services ineffective—the lack of both exacerbates the impact of environmental disasters.

Disaster events can have serious implications for income inequality and persistence of poverty even as households adopt new risk diversification strategies in the aftermath of disasters. The loss of productive assets, income, and livelihoods from natural calamities has long-term economic and social consequences. It takes several years for the poor to recover to their pre-disaster consumption levels. Inadequate food and nutrition deteriorate health and life expectancy, and are likely to perpetuate poverty. Children left out of school may not return. Poor households may not only have their entire life savings wiped out, but also lose their creditworthiness in the process.

Our analysis of the impact of typhoons in the Philippines shows that disasters can push nonpoor households into poverty and the poor even deeper into poverty. In terms of relative mobility, our findings suggest that households that experienced typhoons are more likely to fall into a lower income quantile than those who didn't experience typhoons. In terms of absolute mobility, the incomes of households that were hit by typhoons are more likely to grow more slowly than the incomes of households that were not hit. These results are intuitive as disasters bring damage to life, property, and livelihood. As these damages affect the households' capacity to cope and recover, a disaster can push families into a downward income spiral. Our analysis also finds some indication of a creative destruction effect—disasters can have positive effects on economic mobility. This can be attributed to the government's proactive growth-stimulating post-disaster recovery and reconstruction programs.

Just as prevention is better than cure for a disease, so is preparedness (or risk reduction) better than ad hoc management of a natural disaster. Better institutions and significant investments in appropriate structures, buildings, and other infrastructure—along with well-designed social safety nets—are necessary to improve resistance and adaptability to calamities, and in turn mitigate the need for recovery and restoration. While the government may have no control over the hazard of an extreme environmental or geological event, it should be able to exercise some control over the tendency of populations to settle in high-risk areas. Better weather monitoring, early warning systems, well-planned evacuation programs, well-organized shelter facilities, and well-stocked relief inventories enable governments to prevent natural events from becoming catastrophes, thereby reducing disaster risk. Indeed, when properly implemented, such programs can stimulate job creation and local economy, propelling a stagnating economy onto a virtuous path of growth and income mobility.

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