Comparative Study of Hurricane and Typhoon Induced Damage and Impact on Households in the United States and Japan

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Introduction

Community resilience is defined as "the ability of social systems, be they the constituent element of a community or society, along with the biophysical systems upon which they depend, to resist or absorb the impacts (deaths, damage, losses, etc.) of natural hazards, to rapidly recover from those impacts and to reduce future vulnerabilities through adaptive strategies" (Peacock et al., 2008). Severe windstorms, including hurricanes and tornadoes, threaten the livelihood of millions of people in both developing and developed countries. As highly industrialized nations, the U.S. and Japan differ in demographics, political systems, engineering practices, and business operations all of which are deemed critical factors of determining the trajectory of post-disaster recoveries. Therefore, there is a critical need to advance current understanding of roles of individuals, private corporations, and public institutions in the context of windstorms across nation boundaries and to inform future policy decisions on an international level.

Survey Instrument Development

Curated data from real hazards, constructed facilities, and socio-economic systems within and between communities provides a major source for validation of simulation models that are developed at component level (e.g., reinforced concrete beam or masonry wall), system level (e.g., structural system, transportation system, power system, or emergency management systems), and/or community level (response and recovery systems, economic recovery). Richer and more granular datasets would allow sophisticated methods to be developed across dimensions of recovery – infrastructures, housing, business/commercial facilities, public institutions, and social/economic processes – and later incorporated into simulation models that forecast recovery rates and patterns after a major disaster (NRC, 2006). Also, the data can be used to develop multi-scale simulation models that link the performance of buildings and lifelines to communities (NRC, 2011).

This project aims to examine households in the U.S. and Japan that were affected by hurricanes/ typhoons to compare and contract their recovery processes. It involves both data collection and review of existing policies, legislations, and practices that serve as important context.

The survey questions are grouped in six broad categories:

- Home characteristics: number of stories, size and value, foundation type, and ownership
- Disaster preparation: insurance, mitigation features, and emergency plan
- Evacuation and relocation: cost, duration, and destination
- Damage and losses: wind and water damage, cost, repair time
- Infrastructure interruption: utilities outages, interruption to transportation, medical service, and food supply, public safety
- Recovery: recovery status and time, resource provider

The basic demographic information of respondents (e.g., income, employment status, gender, age, education, race) is recorded.

At the beginning of the survey, there are several screening questions to make sure that the respondents are appropriate to participate. They specify the tenure

(>=12 months), location of their homes (affected by the storm, the type of structure (single or multi-family) and ownership (owner, not renter).

Sampling Frame and Deployment

The team identified four recent tropical storms – two in the U.S. and two in Japan – based on their intensity and impacts.

Storm Name	Intensity at landfall	Year/ Month	Death	Economic Loss
Laura	Cat. 4	Aug, 2020	77	$19b
Ida	Cat. 4	Aug/Sept, 2021	115	$75b
Faxai	Cat. 2	Sept, 2019	9	$10b
Hagibis	Cat. 1	Oct, 2019	105	$15b

The sampling frame is households living in areas greatly affected by these tropical storms. Since the damage to homes could be caused by high wind, flooding, or both, a set of criterions was used to further isolate the zip code within the large regions on their tracks as follows:

- In-situ wind speed at or exceeding design wind speed in the building code
- In-situ flood depth exceeding 4 inches

In the U.S., the household survey is outsourced to a professional firm that will select respondents randomly based on the screening criteria and location. In Japan, the questionnaire is sent by post to residents in selected areas affected by the two typhoons.

Conclusion

This research aims to reveal the similarities and differences in recovery patterns between the U.S. and Japan after major tropical storms. A common set of questions are developed to ensure the internal validity and comparability. Certain questions are modified to reflect the local conditions and customs.

Once the data is collected, logistic regression models will be used to explain the cause-effect relationship between the state of household recovery (dependent variable) and the storm attributes and damages (independent variables) controlled by nation, home size, value, ownership, and other factors. These models are expected to serve as a basis for projecting the community recovery progress for future storm scenarios.

Reference

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