

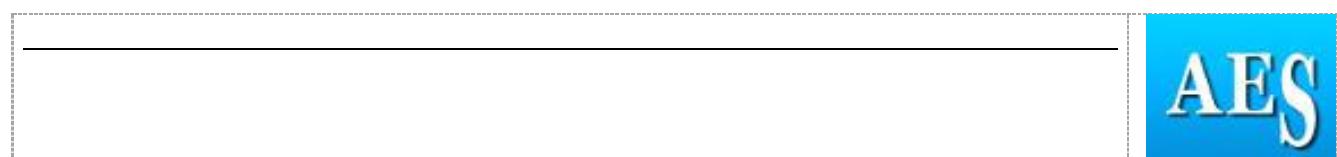
Extended Abstract
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Paper/Poster Title	Designing Better Strategies to Cope with Natural Disasters: Evidence from Typhoon Morakot in Taiwan
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Abstract prepared for presentation at the 97th Annual Conference of the Agricultural Economics Society, The University of Warwick, United Kingdom

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Abstract	200 words max
The increasing intensity of natural disasters accentuates the importance of current coping strategies which play critical roles both in pre-disaster mitigation and post-disaster recovery. Particularly, rural areas often face more fierce threats due to peripheral locations and fewer infrastructures. Designing better strategies is an urgent call. However, the current discussion of such strategies is limited, and quantitative researches shed little light on this issue. This study examines the medium- and long-term recovery of the victims of Typhoon Morakot which struck Taiwan in 2009 and caused severe damage in the rural south. Our research questions are threefold. First, we estimate the effect of evacuation behaviour on both post-disaster economic and mental recovery. Second, the effects of eclectic housing decisions on victims, including village relocation policy provided by the government or NGOs are compared. In addition, we expound upon the mental health differences between victims and non-victims combining pooled survey data. Using the instrumental variable method, the preliminary medium-term results show that the evacuation caused household income decreases by \$384 on average after a year, which accounted for more than one-third of the average income of the study area before Morakot hit.	
Keywords	Evacuation, relocation, natural disaster, rural area
JEL Code	Health: Health and Inequality I14; Environmental Economics: Valuation of Environmental Effects Q51; Climate; Environmental Economics: Natural Disasters and Their Management; Global Warming Q54; Household Analysis: Other R29 see: www.aeaweb.org/jel/guide/jel.php?class=Q)
Introduction	100 – 250 words
Understanding rural livelihood is crucial in the context of sustainable development. As the impacts of climate change increase in several arenas, the rising frequencies and intensities of harsh weather disasters are detrimental to human societies. Numerous rural villages located in mountainous or watershed areas worldwide suffer even more frequently. Past studies show that disasters cause not only short-run effects, but also long-run economic and welfare loss (Hornbeck, 2014; Deryugina and Molitor, 2020). Designing better coping strategies is an emergent call, which helps rural people to mitigate and overcome serious aftermaths, and bring back living conditions in a shorter	



time. In this regard, examining the effect of current strategies sheds light on resilience building (Grove, 2018).

Typhoon Morakot hit Taiwan in 2009. It killed over 650 people. This study examines the effects of two behaviours adopted by victims before/after the Morakot strike, evacuation and housing decisions, which includes village relocation, on after-disaster economic and mental conditions. In addition, we make a comparison between the effects of Morakot hit on the mental health differences between victims and non-victims. A post-Morakot census panel following the victims is used in this study.

This study contributes to the understanding of the current coping strategies and may provide advice for adjustments in policy designs for rural areas. Echoing Deryugina and Molitor (2020) in which the effect of migration behaviour of victims on mortality was examined, the findings in this study can provide recommendations for existing strategies and offer insights into both pre- and post-disaster resilience building.

Methodology	100 – 250 words
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Both the instrumental variable (IV) and difference-in-difference (DID) methods are used to approach different research questions. To address these questions, one must consider the possible selection bias which arises from unobserved covariates of the outcome and the treatment which are evacuation behaviour and housing decisions in this case. The IV method eliminates such concern if a proper IV is found. In addition, to find out the effect of Morakot hit on mental health, we use DID method to deal with the selection problem. Empirically, we use the monthly income differences between the survey years and pre-disaster income as the economic outcome, and questions involving mental health in the census as the mental health outcome. While previous studies often use information access as IV, it is argued in this study that precipitation serves as a better alternative. Precipitation is random in nature, and it does not directly influence the income differences since the latter was measured at least one year after the typhoon. The mental health conditions were asked regarding the last two weeks when the survey took place. Particularly, the squared term of precipitation is added as IV as well.

To carry out the analysis, we use a census panel for Morakot victims. The census was conducted in the years 2010, '11, '12, and '15. In addition, to compare the Morakot effect between victims and non-victims, a pooled cross-sectional dataset is included into our analysis. Statistics on weather conditions including precipitation are organized and combined with the data.

Results	100 – 250 words
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The main results are still in progress. Some medium-term preliminary results examining the recovery conditions using the first-year data in the panel are presented in this summary. Our data includes 1,513 observations. The average household's monthly income was \$932.8 in the pre-Morakot period and \$865.4 after one year of Morakot strike. The t-test and ANOVA are also used to examine whether there are substantial differences in outcomes between groups. The monthly income is statistically lower for victims in the post-disaster year. There is no difference between evacuation groups, but for village relocation adopters, the post-disaster income is higher than victims who were not been relocated.

The first-stage results show that the precipitation serves as a valid IV for both evacuation and village reallocation. The IV results show that evacuation caused households' monthly income decreases by \$384 on average after a year of the Morakot hit. On the other hand, the village relocation increases households' income by \$357.6. The estimated result of evacuation shows the need for designing better evacuation procedures. The mental conditions are all insignificant regarding the evacuation. However, for victims who adopted village relocation, several conditions were substantially improved, reflected by less frequent headaches, palpitation, limb tremor, and report of less mental burden about things or people.

The aboriginal people who adopted evacuation perform better in post-disaster economic recovery for a monthly income of \$145. However, they perform worse than average under the village relocation scenario, by \$125.5. Several measures of mental health conditions show that they are more struggling than others.

Discussion and Conclusion	100 – 250 words
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Although people were told that evacuation saves lives, the compulsory process was not well organized at that time, resulting in a deadly incident that a village covered by mudflow. Yet, the tragedy could be rewritten if people evacuated voluntarily. Drawing upon the preliminary results, such change can be encouraged by providing more economic incentives for evacuation. A better evacuation procedure should take this into account. We also find that aboriginal people tend to perform better economically after the Morakot hit. This may be due to their tendency to live a self-sufficient life within tribes. Another possibility is that aborigines performed weaker than average before the typhoon, and most incomes were from transfer payments or government subsidies, therefore the post-Morakot subsidy increased their income. But this guess needs further validation.

The village reallocation policy showed substantial benefits for victims in terms of economic income and mental conditions. This result proves the policy intention and reveals the fact that a quick response in the settlement is crucial in the medium-term recovery. Nevertheless, aboriginal people have a worse experience compared to others. Their economic benefit is low accompanied by worse mental conditions in the relocation villages. This may be the result of a great change in their own culture and lifestyle.

Natural disasters are primary influences on human society. To make hay while the sun shines, the current study contributes to how mitigation strategies can be designed for building resilience in rural areas confronting future disasters.