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Household Food Consumption and Poverty Reduction After Earthquakes: Evidence from Lombok

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ABSTRACT

Research Originality: This study contributes to the literature by examining how household food consumption mitigates the poverty impact of earthquakes, an area that remains underexplored in post-disaster economic studies.

Research Objectives: The study aims to analyze the role of per capita household food consumption in poverty reduction after the Lombok earthquake and to highlight its importance for economic recovery.

Research Methods: This study uses panel data from 10 districts/cities in West Nusa Tenggara (2011-2019) to employ the First-Difference Generalised Method of Moments (FDGMM) to address potential endogeneity and estimate the causal relationship between food consumption and poverty.

Empirical Results: The results show that per capita food consumption significantly reduces poverty under normal conditions and after a disaster. Meanwhile, economic growth positively impacts poverty, suggesting that the observed growth is not inclusive. The study also finds that the direct effect of the earthquake on food consumption is statistically insignificant, suggesting that other factors, such as relief programs, may have played a role in stabilizing consumption.

Implications: These findings underscore the importance of policies that enhance food security and equitable distribution, particularly in post-disaster contexts. Strengthening social protection programs and ensuring inclusive economic growth is essential for long-term poverty reduction in disaster-prone areas.

Keywords:
poverty; food consumption; disaster; household resilience

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INTRODUCTION

The Central Statistics Agency (BPS, Badan Pusat Statistik) has revealed that the poverty rate in NTB has continued to decline. From 2011 to 2019, the poverty rate fell from 19.73% to 14.56% (Badan Pusat Statistik, 2020). This decline has been sustained since 2018, despite the region experiencing a substantial earthquake that significantly impacted its socio-economic landscape (Agustawijaya et al., 2020; Ang et al., 2024; Isnaeni et al., 2022; Roslinawati, 2021). The seismic event was experienced across most Lombok and Sumbawa Islands, indicating the presence of factors contributing to the region's social and economic resilience. A salient factor that must be considered is household consumption capacity, with a particular emphasis on the food sector.

The role of food consumption in post-disaster recovery is of pivotal significance, primarily in addressing food insecurity and enhancing community resilience. Access to nutritious food has been demonstrated to have a significant impact on mental health, with studies indicating a reduction in stress and depression among disaster survivors (Sioen et al., 2017). Nevertheless, studies have also indicated the compromise of food security in the aftermath of disasters. Research findings demonstrate that food access is worsened in marginalized communities following events such as Hurricane Katrina (Singleton et al., 2022). Providing emergency food and utilizing local food resources are considered essential strategies for mitigating food insecurity and supporting recovery efforts (Durry et al., 2024; Lassa et al., 2018). Community feeding initiatives have been demonstrated to engender social support, which is imperative for coping with the psychological effects of disasters (Clay et al., 2022). In conclusion, the effective distribution of food and the provision of access to nutritious options are integral to the reconstruction of communities and the enhancement of their resilience against future disasters (Clay & Ross, 2020).

In the study of the impact of disasters on the economy, most previous studies have focused more on macroeconomic recovery and infrastructure reconstruction as the main strategies for reducing the long-term impact of disasters. Examples of relevant studies include Li et al. (2022), Nugroho et al. (2022), Sseruyange & Klomp (2021), Duqi et al. (2021), Blagojević et al. (2022) and Duan (2022), who discuss how post-disaster economic recovery strategies focus more on GDP growth and infrastructure development. However, these studies do not adequately address the role of household consumption in this context. A macroeconomic approach often overlooks the socio-economic dynamics at the micro level, particularly about household consumption and food security in the context of disaster impacts.

In contrast, recent studies, including those by Chen et al. (2024), Barakat et al. (2023), Dailey et al. (2022), and Fraser et al. (2022) have begun to emphasize the significance of food security in crisis response, particularly in the context of pandemics and natural disasters. While these studies address the role of food consumption in emergencies, their research does not explicitly examine how household food consumption contributes to post-disaster poverty reduction. Furthermore, many studies have emphasized the role

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of social assistance and government intervention in mitigating the impact of disasters. Significant contributions in this area have been made by Kuntjorowati et al. (2022), Emrich et al. (2022), Karnaji et al. (2023), and Drakes et al. (2021). These studies have demonstrated the pivotal role that social assistance programs, such as cash transfers and food subsidies, play in ensuring the economic stability of households in the aftermath of a disaster. However, these studies have not explicitly linked how household food consumption patterns can mitigate poverty after a disaster.

This study addresses a significant gap in the extant literature by examining food consumption's direct impact on poverty reduction in post-disaster settings. This area has not been thoroughly explored in previous research. Although the Lombok earthquake occurred several years ago, the findings of this study are still important for informing future disaster preparedness and long-term socio-economic recovery strategies, especially in areas prone to recurring natural disasters. The present study employs the FDGMM method to establish causal relationships rigorously and provide policy recommendations to enhance food security and household well-being in disaster-stricken areas.

METHODS

This study employs a panel data approach, encompassing 10 districts/cities in NTB from 2011 to 2019, to examine the impact of household food consumption on poverty reduction in post-disaster environments. The selection of the study period is of particular significance to ensure that the analysis captures the impact of the 2018 Lombok earthquake while minimizing extraneous influences. The decision to restrict the analysis to the 2019 dataset is based on the principle of minimizing confounding while recognizing that the economic disruptions associated with the onset of the pandemic in early 2020 could potentially introduce bias. Akita and Alisjahbana (2023) asserted that the Indonesian economy underwent a substantial contraction in the wake of the pandemic, underscoring the imperative to exclude 2020 data from the analysis to preserve the model's validity. This methodological decision ensured that the observed relationship between household consumption and poverty was predominantly driven by disaster-related factors rather than economic shocks caused by the pandemic.

To address potential endogeneity issues and ensure robust estimations, this study employs the First-Difference Generalised Method of Moments (FDGMM) estimator. This method is particularly well-suited for dynamic panel data analysis, as it effectively controls for unobserved heterogeneity, simultaneity bias, and measurement errors in explanatory variables. The validity of the FDGMM hinges on the condition that the number of units (N) exceeds the number of periods (T), ensuring reliable instrument selection and averting overfitting. In this study, with N = 10 (districts/cities) and T = 9 (years), the condition N > T is satisfied, thereby validating the utilization of this estimation technique. The analysis incorporates control variables, namely gross domestic income and the open unemployment rate (Anwar et al., 2024; Langi, 2023). The regression equation is as follows:

$$P0_{i,t} = \alpha_{i,t} + \beta_1 GRDP_{i,t} + \beta_2 UNE_{i,t} + \beta_3 EQ_t + \varepsilon_{i,t} \quad (1)$$

$$P_{0i,t} = \alpha_{i,t} + \beta_1 GRDP_{i,t} + \beta_2 UNE_{i,t} + \beta_3 EQ_t + \beta_4 FC_{i,t} + \beta_5 EQ.FC_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$FC_{i,t} = \alpha_{i,t} + \beta_1 GRDP_{i,t} + \beta_2 UNE_{i,t} + \beta_3 EQ_t + \varepsilon_{i,t} \quad (3)$$

where $P0_{i,t}$ represents the poverty rate in district i at time t, measured as the percentage of the poor population in the province. $GRDP_{i,t}$denotes the Gross Regional Domestic Product (GRDP), expressed in million rupiahs, reflecting the economic output of each region. $UNE_{i,t}$ is the unemployment rate, measured as the percentage of unemployed individuals within the workforce in each province. EQ_t is a dummy variable that assumes the value 1 if the observation falls within the designated earthquake period (2018–2019) and 0 in all other instances. The model has also been enhanced by the incorporation of an error term $\varepsilon_{i,t}$ which is essential in accounting for unobserved influences on the dependent variable.

The initial regression formula was developed for the purpose of evaluating poverty rates in areas affected by the earthquake, both prior to and following the disaster. The objective of this comparison is to facilitate a more nuanced comprehension of the poverty conditions that prevailed in the aforementioned areas during the periods preceding and succeeding the earthquake. The second regression formula is employed to analyse the effect of household food consumption on poverty levels and to explore whether there is a difference in its effect between the pre- and post-earthquake periods. $FC_{i,t}$is employed to denote household food consumption per capita, measured in rupiahs. This indicates the average food expenditure per individual. The interaction term $EQ.FC_{i,t}$ has been incorporated into the model in order to analyse whether the effect of food consumption on poverty varies between normal and disaster periods. The addition will provide a clearer picture of the fact that the second regression not only looks at the relationship between food consumption and poverty, but also compares its effect in two different periods.

The third regression formula is employed to verify the stability of the findings of the second regression. Suppose the second model finds insignificant household food consumption and the earthquake's interaction effects. In that case, the third model is expected to conclude that the earthquake does not affect the level of consumption. The estimation process employs a two-step General Method of Moments (GMM) approach, encompassing the Arellano-Bond test for serial correlation and the Sargan test for over-identifying restrictions, to validate the model's instrument specification. These tests ensure that the selected instruments are appropriate and that the model assumptions are correct. This methodological framework facilitates a more precise identification of causal relationships between food consumption and poverty reduction, accounting for disaster-related shocks and economic trends in NTB before the pandemic.

RESULTS AND DISCUSSION

The primary conclusions of this study suggest that household food consumption plays a substantial role in reducing poverty levels in NTB Province, both in normal and

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post-disaster contexts. The analysis utilizing the FDGMM reveals that per capita food consumption exerts a negative and significant influence on poverty levels, indicating that an increase in household food consumption is associated with a decline in poverty. Furthermore, the findings suggest that economic growth in NTB is not yet inclusive, indicating that the increase in GRDP has not positively impacted the poor.

In addition to confirming that poverty decreased significantly after the earthquake, the findings of the first regression model demonstrate a positive and significant correlation between economic growth and poverty levels (see Table 1). This result indicates that the economic growth experienced during 2011–2019 was not inclusive and led to an escalation in inequality. This finding is consistent with the conclusions of previous studies by Adeleye et al. (2020), Škare and Družeta (2016), and Timiryanova et al. (2021), who also found that uneven economic growth can worsen the conditions of vulnerable groups (Altamirano, 2019; Narain, 2022). The underlying reason for this phenomenon is the limited access that vulnerable groups have to existing economic resources.

Table 1. The Effect of Earthquakes on Poverty

Explanatory variables	Dependent variables: LnP0			
	Coef.	Std. error	z	P > [z]
LnP0 (-1)	0,7959103***	0,0272333	29,23	0,000
LnGRDP	0,06397***	0,0205973	3,11	0,002
LnUNE	0,0246816***	0,0090975	2,71	0,007
EQ	-0,033512***	0,0038262	-8,76	0,000
CONSTANTA	-0,5240401	0,3963511	-1,32	0,186
Number of groups	10			
Number of instruments	41			
Wald chi2	10.593,57			
Prob. > chi2	0,0000			
Arellano-Bond test for AR(1)	0,1217			
Arellano-Bond test for AR(2)	0,8237			
Sargan test	1,0000			
Number of Obs.	67			

Note:*** significant at 1%, ** significant at 5%, * significant at 10%

Incorporating the per capita food consumption variable in the second regression model reveals a negative and significant relationship between food consumption and poverty (see Table 2). This finding suggests that maintaining stable food consumption is crucial for poor households to withstand challenging economic conditions. This finding is consistent with the conclusions of research conducted by Davis and Geiger (2017), Gorzycka-Sikora et al. (2023), and Hermans et al. (2024), which demonstrates that food consumption plays a pivotal role in safeguarding the economic well-being of disadvantaged populations, particularly during periods of crisis. The present study also

demonstrated that the interaction variable between the earthquake and per capita food consumption did not significantly affect poverty levels. This finding suggests that per capita food consumption in the second model remained constant between the pre-and post-earthquake periods.

The present study explores the significance of stable food consumption for impoverished households in challenging economic conditions, offering profound insights into household economic resilience during crises and in normal circumstances. The analysis posits that food consumption is not solely a means of fulfilling fundamental needs but also an indicator of broader well-being (Verba et al., 2023). In ordinary conditions, impoverished households frequently encounter constrained access to economic resources, including low-income and job instability. Consequently, maintaining stable food consumption emerges as a pivotal strategy for sustaining quality of life and averting a more precipitous decline in well-being. When food consumption remains stable, even at a lower level, impoverished households can mitigate the risk of health complications and hunger that frequently ensue due to constrained resources (Ghalibaf et al., 2022).

Table 2. The Effect of Earthquakes and Per Capita Food Consumption on Poverty

Explanatory variables	Dependent variables: LnP0			
	Coef.	Std. error	z	P > [z]
LnP0 (-1)	0,6192719***	0,0884735	7,00	0,000
LnGRDP	0,0605877**	0,0271719	2,23	0,026
LnUNE	0,0210639*	0,0119575	1,76	0,078
EQ	-1,444897	1,857391	-0,78	0,437
LnFC	-0,106169***	0,0412896	-2,57	0,010
LnEQ.FC	0,1070018	0,1405605	0,76	0,447
CONSTANTA	1,390898*	0,726503	1,91	0,056
Number of groups	10			
Number of instruments	42			
Wald chi2	1810,29			
Prob. > chi2	0,0000			
Arellano-Bond test for AR(1)	0,1405			
Arellano-Bond test for AR(2)	0,8352			
Sargan test	1,0000			
Number of Obs.	67			

Note:*** significant at 1%, ** significant at 5%, * significant at 10%

In situations of crisis, such as natural disasters or economic shocks, there is an increase in the challenges to household food consumption (Orjiakor et al., 2023). Crises caused by natural disasters, such as earthquakes, damage local infrastructure and economies and disrupt social stability and food distribution. Poor households already in a

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vulnerable position are more easily affected by the direct and indirect impacts of the crisis. In such circumstances, food consumption is pivotal in determining households' resilience. Food security is critical in post-crisis recovery (Yang & Tian, 2024). Households with greater access to food consumption, facilitated by social support or food assistance policies, are better equipped to withstand and recuperate from the repercussions of the crisis. It is imperative to implement policies that facilitate easier and more equitable access to healthy and nutritious food consumption, as this is instrumental in preventing an escalation in poverty levels and reducing vulnerability to economic shocks. Social assistance programs, food subsidies, and enhancements in food distribution infrastructure are pivotal aspects that demand significant consideration. These measures act as a stabilizing factor, thereby mitigating the impact of uncertainty on food consumption among economically disadvantaged households (Amrullah et al., 2023; Dinda Pramisita et al., 2023; Susantyo, 2023).

The findings of the third regression model demonstrate that the 2018 Lombok earthquake did not substantially influence the level of food consumption per capita (see Table 3). This outcome is consistent with the results of the preceding second model, which indicated no significant variation in the impact of consumption on poverty between the periods before and after the earthquake disaster. Consequently, food consumption per capita during the disaster period remained consistent. This stability is likely influenced by government intervention, community concern, and private corporations providing social assistance, food subsidies, and logistics distribution to affected areas.

Table 3. The Effect of Earthquakes on Per Capita Food Consumption

Explanatory variables	Dependent variables: LnFC			
	Coef.	Std. error	z	P > [z]
LnFC (-1)	0,7156724***	0,0636269	11,25	0,000
LnGRDP	0,1602103***	0,059029	2,71	0,007
LnUNE	-0,1491802	0,1232053	-1,21	0,226
EQ	0,0201478	0,0274421	0,73	0,463
CONSTANTA	1,392241***	0,3775068	3,69	0,000
Number of groups	10			
Number of instruments	41			
Wald chi2	1.739,73			
Prob. > chi2	0,0000			
Arellano-Bond test for AR(1)	0,0278			
Arellano-Bond test for AR(2)	0,9452			
Sargan test	1,0000			
Number of Obs.	67			

Note:*** significant at 1%, ** significant at 5%, * significant at 10%

CONCLUSION

The findings of the research indicate that household food consumption plays a pivotal role in alleviating poverty levels in NTB, both in normal and post-disaster conditions. Stable food consumption assists impoverished households in preserving their economic well-being in challenging circumstances, constituting a pivotal factor in poverty reduction strategies. The study further reveals that economic growth in NTB during 2011–2019 was not inclusive. This result suggests that the benefits of economic growth have not been universally experienced, particularly among the economically disadvantaged. Furthermore, the study revealed that the 2018 Lombok earthquake did not substantially influence per capita food consumption levels, underscoring the significance of social interventions such as food aid and logistical support in maintaining the stability of consumption among affected communities.

The results of the present study indicate several policy implications for government and stakeholders to consider. Primarily, the government must ensure that ongoing economic growth is more inclusive. This condition can be achieved by creating more opportunities for economically disadvantaged groups to participate in economic activities. Programs such as labor-intensive programs, skills training, and access to capital for micro-enterprises can be alternative policies to help reduce economic disparities. Secondly, the study emphasizes the necessity of ensuring food consumption stability as a priority in policies aimed at poverty alleviation. Achieving this objective can be facilitated by consolidating food-based social assistance programs, implementing staple food subsidies, and providing support to local food production. The study contends that these measures ensure that vulnerable populations can access their basic needs, particularly during crises. Thirdly, the study calls for increased social interventions in the form of rapid and targeted aid distribution, emphasizing the importance of enhancing the effectiveness of such measures in reducing the negative impacts of disasters on vulnerable groups.

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