

Social Capital and Food Security in the Face of Disasters: A New Insight from Rural Households in Indonesia

Thomas Soseco¹

Universitas Negeri Malang, Indonesia

*Email: thomas.soseco.fe@um.ac.id

Isnawati Hidayah

Department of Economics and Law, Sapienza University of Rome, Italy

Center of Economic and Law Studies (CELIOS)

Nila Cahayati

Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia

Fajar Try Leksono

ROTASI Institute (Institute for Rural Development and Sustainability), Indonesia

Yessi Rahmawati

Department of Economics, Faculty of Economic and Business, Airlangga University, Indonesia

Abstract

As Indonesia is prone to natural disasters, households need the ability to maintain their resilience and living standards by enhancing social capital in the community. This paper examines the impact of natural disasters on a household's standard of living measured from food expenditure when social capital exists. Data is obtained from the Indonesian Family Life Survey (IFLS) 2014 and analysed using a regression model and quantile regression. Our findings show that natural disasters impact poor households more than non-poor ones. When social capital exists, it can help households to maintain their standard of living, as observed by food expenditures. Policies should focus on increasing the household standard of living, so households have a financial buffer to deal with financial shocks like natural disasters. Besides, enhancing social participation at the poor and the lowest administration level is required to create a stronger social capital.

Keywords: food expenditure, social capital, natural disasters

JEL Classification: D10, I31, Q54,

1. Introduction

Indonesia lies at the intersection of the Ring of Fire and the Alpide belt, which makes it prone to natural disasters, where in 2011-2021, there has been an increase in natural disasters in Indonesia, from 1,637 incidences in 2011 to 1,978 incidences in 2021. Three disasters

¹ Corresponding address: Fakultas Ekonomi dan Bisnis, Universitas Negeri Malang, Jl. Semarang 5, Malang, Indonesia. Email: thomas.soseco.fe@um.ac.id

frequently happen within one year in Indonesia, namely floods, strong winds, and landslides which compromise respectively about 32%, 30%, and 22% of natural disasters (Badan Nasional Penanggulangan Bencana, 2022).

Natural disasters destruct infrastructure and slow down economic development as governments must frequently use the money to rebuild infrastructure (United Nations, 2016). Natural disasters directly impact humanity through casualties, inability to access property due to physical damage, and increased socio-economic problems (Benson, 1997; De Haen & Hemrich, 2007; Lindell & Prater, 2003; Pelling et al., 2002).

Natural disasters in Indonesia warrant more attention than those in developed countries, as developing nations bear a more significant economic burden in the wake of such events (Arouri et al., 2015; Ludwig et al., 2007; Panwar & Sen, 2018). The agricultural communities in rural areas that depend on nature for their earnings are the characteristics of the population in developing countries that are considered the most vulnerable communities to disasters (Jones & Olken, 2010; Paterson et al., 2015).

The focus should also be given to the poor or marginalised communities as the worse impact of disasters in the form of human capital depletion due to loss of life, missing or injured persons, and displacement are found on the poor (De Haen & Hemrich, 2007; Ludwig et al., 2007; Nadaamist, 2022). Other studies found that poor people are more vulnerable to natural disasters due to their type and place of residence, building construction, and social exclusion (Dartanto, 2022; Fothergill & Peek, 2004; Lal et al., 2009). Vulnerable households typically face difficulties in securing their basic necessities as they lack sufficient savings, have limited income, and may experience the loss of their primary sources of livelihood. This combination of factors leaves them particularly susceptible to economic shocks, such as those caused by natural disasters or unexpected expenses, making it challenging to meet their essential needs. As a result, these households are at greater risk of falling into poverty or experiencing heightened financial insecurity (Chowdhury et al., 2019). Dartanto (2022) found the approximate monetary value of loss from natural disasters in Indonesia is USD 2,190/household due to asset destruction and medical/funeral costs. In Indonesia, earthquakes are the most destructive disaster to affect household welfare, whereas droughts, forest fires, and floods have moderate effects (Dartanto, 2022).

Considering the hazards and potential impact of natural disasters, we need to empower the population, so they are resilient to natural disasters shown by their ability to maintain their standard of living. One way to support this resilience is through increasing social capital, defined as social relationships that are resources that can lead to the development and accumulation of human capital (Machalek & Martin, 2015). Social capital is one of the fundamental basis of community engagements to build up disaster resilience (MacRae & Hodgkin, 2011) besides non-government organizations (NGOs)'s interventions (Pierre-Louis, 2011) and shared communication and information (Miyaguchi & Shaw, 2007).

This research holds significant importance in the context of disaster-prone regions like Indonesia. Its findings underscore the disproportionate impact of natural disasters on vulnerable, economically disadvantaged households. Importantly, the research highlights the potential of social capital in mitigating these adverse effects and enabling households to sustain their living standards. These insights carry substantial policy implications, emphasizing the need for interventions aimed at elevating household living standards to create financial safety nets against unexpected financial shocks, such as those brought about by natural disasters. Furthermore, the research underscores the significance of promoting social participation at the grassroots level, particularly within impoverished communities, to foster stronger social capital that can act as a buffer during times of crisis. In sum, this study contributes to the understanding of disaster resilience and underscores the role of social capital in building more resilient and adaptive communities in disaster-prone regions. The rest of this paper is structured as follows. Section 2 presents a literature review of the role of social capital on food resilience. Section 3 describes the methodology and data. Section 4 presents the result of estimation and policy implications. Then, Section 5 presents the conclusion and recommendations for future studies.

2. Social Capital and Food Resilience in Rural Households in Indonesia

Social capital is defined as social relationships that are resources that can lead to the development and accumulation of human capital (Machalek & Martin, 2015). The three types of social capital that are commonly found in the community are bonding, bridging, and linking (Grootaert et al., 2004). Bonding social capital refers to internal social capital within community groups, such as relationships between family members, close friends, neighbours,

or people of the same race (Putnam, 2000). Bridging social capital refers to the external social capital offered by individuals from different ethnic backgrounds, geographic locations, or professional specializations (Szreter & Woolcock, 2004). While linking social capital develops between community members and those working in formal institutions such as local government (Grootaert et al., 2004; Soseco, 2021; Woolcock & Narayan, 2000)

One example of social capital among the population is when farmers ask their friends or relatives for help when they need to borrow money, build a house, or need food. These interpersonal relationships are very important due to the absence of a formal safety net. It is also possible that other strategies can also work, such as exchanging food for job relocation, getting help from environmental organizations, or moving (migrating) (Morton, 2007). Based on the example above, social capital helps farmers access capital and job opportunities among the farmers' community due to their bonding and networking.

The role of social capital in providing support for households after disasters is explained by many scholars, for example, it was found that binding social capital provided necessary food and non-food support to people affected by floods in Myanmar and Taiwan in 2012 before government officials could reach them in time (James, 2014). Other studies found that social capital plays an important role in supporting households' resilience in recovery from natural disasters (Aldrich, 2012; Bhandari, 2014; Weil et al., 2012).

In the literature on disaster management, social capital and strong social ties are more important than government assistance in assisting disaster victims in dealing with and recovering from disasters (Aldrich, 2012; Bhandari, 2014; Weil et al., 2012). Thus, better disaster resilience requires strong social capital (Jovita et al., 2019; Murphy, 2011; Shaw & Goda, 2004).

Nosratabadi et al. (2020) explain that social capital increases food security through two mechanisms of knowledge sharing and product sharing, i.e., sharing food products, resulting in households with limited financial or food resources being less likely to experience hunger if they have high levels of social capital. Therefore, communities with high levels of social capital are much more likely to have multiple food sources than communities with low levels of social capital. Furthermore, Jovita et al. (2019) defined social capital as the potential resources in goods, labour, and other forms of assistance that are embedded in local-level social networks of family and neighbours, and other groups formed through place-based,

work-based, and common interest-based bonds of interaction, trust, reciprocity, and support that people can mobilize individually and collectively to use for community resilience in the face of disasters. Hence, social capital has an important role either in increasing food security especially while facing and recovering from disasters.

3. Method dan Data

The dataset utilized in this study is sourced from the Indonesian Family Life Survey (IFLS), a comprehensive data collection initiative that gathers extensive socioeconomic data on households situated in 13 provinces across Indonesia. These provinces encompass regions such as Java, Sumatera, Bali, Kalimantan, Sulawesi, and Nusa Tenggara. Our analysis is primarily based on the IFLS data from Wave 5, conducted in the year 2014, encompassing a substantial sample of 15,921 households. This research explores the correlation between food expenditure, the dependent variable, and its independent variables through the application of linear regression analysis which is defined as:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i \quad (1)$$

The author(s) test the relationship between social capital and per-capita household food expenditure when social capital is non-existent and compare it with the condition of social capital and food expenditure when it is existent. Then, the author(s) categorize the analysis into two groups: poor and non-poor households, based on their per-capita household food expenditure. The poor are defined as those with per capita food expenditure below the national standard, which in 2014 was set at Rp. 238,278 (about USD16,08) (Badan Pusat Statistik, 2016).

Subsequently, the author(s) employ quantile regression to assess the consistency of effects on the impoverished demographic, as defined in the previous analysis, with observations within the lower deciles. The quantile regression model is expressed as follows (Koenker & Bassett Jr, 1978):

$$y_{it} = x'_{it}\beta_{\theta} + u_{\theta it} \text{ with } Quant_{\theta}(y_{it}|x_{it}) = x'_{it}\beta_{\theta} \quad (2)$$

where y_{it} is the dependent variable, x is a vector of regressors, β is the vector of parameters to be estimated, and u is a vector of residuals. $Q_{\theta}(y_{it}|x_{it})$ identifies the θ^{th} conditional quantile of y_{it} given x_{it} .

The dependent variable is per-capita household food expenditure obtained from the monetary value of household commodities. The use of per capita measurement is required as potential bias may occur when a household may have high food expenditure due to a larger household number. Hence, more accurate estimation is obtained by looking at the food expenditure for each household member.

The independent variables include information on demography, education, employment types, social capital, and disaster experiences during the last five years (2009–2014). In the IFLS5, the social capital assessed is in the form of bonding and bridging, following Nugroho et al. (2022). Two indicators in IFLS5 are used to evaluate bonding. Firstly *“Taking into account the diversity of ethnicities in the village, I trust people with the same ethnicity as mine more”*, and secondly *“Taking into account the diversity of religions in the village, I trust people with the same religion as mine more”*. Meanwhile, three indicators are used to assess bridging. The first is *“I am willing to help people in this village if they need it”*, the second is *“In this village, I have to be alert or someone is likely to take advantage of me”*, and the third is *“I would be willing to ask my neighbours to look after my house if I leave for a few days”*.

Then, the answers in IFLS5 are a 4-point Likert type scale, where 1 means strongly disagree, 2 disagree, three agree, and four strongly agree. For the second indicator on bridging, we score the opposite of the Likert answer, because it is a negative statement. Individuals who answered strongly agreed on the question had high distrust/insecurity (low bridging). Therefore, the score for "strongly agree" answers is 1, and so on. That way, the results are consistent when added together.

Household characteristics of poor and nonpoor are described in Table 1. Our findings show that poor people have lower per capita food expenditure, higher household size, and lower education levels than nonpoor people.

Table 1. Household Characteristics

Variables		Nonpoo r	Poor	NonPoor+Poo r
Per capita food expenditure	Mean	375,494	99,542.9	134,700.9
	Std.Dev.	164,734.9	55,920.0	121,041.2

Household size	Mean	2.318	3.883	3.684
	Std.Dev.	1.406	1.767	1.802
Education (%)	No school	26.22	36.43	35.11
	SD	14.13	24.19	22.89
	SMP	10.23	12.27	12.01
	SMA	25.68	18.81	19.70
	Undergraduate	21.64	7.92	9.69
	Postgraduate	2.1	0.37	0.60
Household head sex (%)	Female	30.02	29.4	29.48
	Male	69.98	70.6	70.52
Employment sector (%)	Agriculture	31.62	14.75	29.24

Source: analysed by authors

Table 2. Household Characteristics (Percent)

Variables	Responses	Nonpoor	Poor	NonPoor+Poor
I am willing to help people in this village if they need it	strongly disagree	0.1	0.13	0.13
	disagree	0.77	0.95	0.92
	agree	74.31	73	73.17
	strongly agree	24.82	25.92	25.77
In this village, I have to be alert, or someone will likely take advantage of me.	strongly disagree	27.23	25.04	25.33
	disagree	62.1	61.53	61.61
	agree	9.38	11.89	11.56
	strongly agree	1.28	1.54	1.51

Taking into account the diversity of ethnicities in the village, I trust people with the same ethnicity as mine more.	strongly disagree	1.74	1.82	1.81
	disagree	39.85	29.38	30.77
	agree	50.41	57.77	56.79
	strongly agree	8	11.03	10.63
Would be willing to leave my children with my neighbours for a few hours if I cannot bring my children along.	strongly disagree	4.07	3.01	3.12
	disagree	41.57	37.42	37.83
	agree	49.61	53.28	52.91
	strongly agree	4.75	6.29	6.14

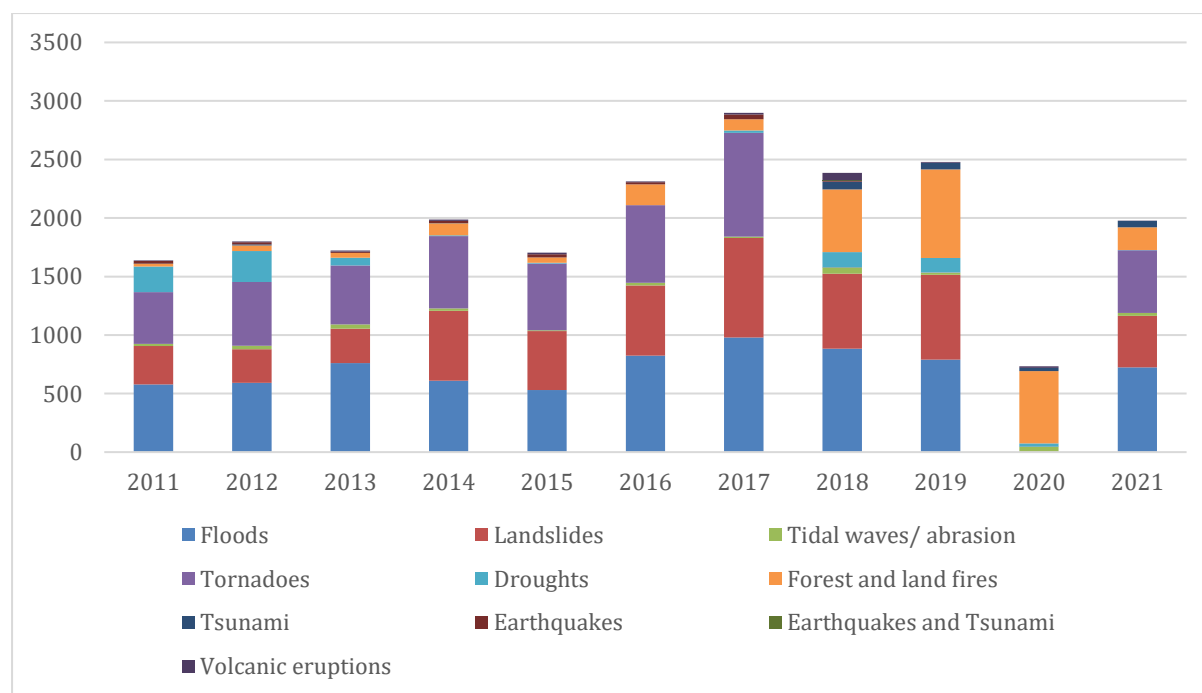
Source: analysed by authors

Table 2 shows in general, poor people have higher trust levels than nonpoor, shown by a higher percentage of poor people who strongly agree and agree and a lower percentage of people who strongly disagree and disagree on each indicator of social capital.

4. Results

4.1. Poor Households are Vulnerable to Disasters

The occurrence of natural disasters in Indonesia increased from 2011-2021 with a peak in 2020 reaching 4,884 incidences. Observation of the disaster types shows floods, tornadoes, and landslides dominate Indonesia's disasters, accounting for approximately 85% of total disasters annually (Table 3).



Source: Badan Nasional Penanggulangan Bencana (2022)

By looking at the disaster experiences, poor households, i.e., those who have per capita food expenditure lower than Rp.238,278 per month, have a higher percentage of disaster experiences than nonpoor households, especially in landslides, volcanic eruptions, tsunamis, and drought. This might be caused by their type and place of residence located in prone to disaster areas, building construction that is vulnerable to disasters, and social exclusion that prohibits them to have support for disasters (Fothergill & Peek, 2004).

Table 4. Natural Disaster Experience

	Nonpoor		Poor	
	No Experience	Experience	No Experience	Experience
Flood	90.5	9.5	92.76	7.24
Landslide/mudslide	99.46	0.54	99.27	0.73
Mudflow	100	0	100	0
Volcanic eruption	97.95	2.05	97.15	2.85
Earthquake	97.91	2.09	97.95	2.05
Tsunami	100	0	99.97	0.03

Windstorm	98.05	1.95	98.46	1.54
Forest fire	99.81	0.19	99.88	0.12
Fire	98.98	1.02	99.06	0.94
Civil Strife	99.56	0.44	99.69	0.31
Drought	99.42	0.58	98.8	1.2

Source: analysed by authors

In contrast to the poor, nonpoor have more disaster experiences in floods, earthquakes, windstorms, forest fires, fires, and civil strife which are less correlated with dwelling types indicating the impact of disasters that can reach society regardless of their socio-economic status (Table 4).

Findings in Table 4 show even though the poor have less experience with disasters than the nonpoor, they might face an inability to maintain the standard of living measured to low food expenditure due to their low financial capacity; hence, the occurrence of disasters can give a more significant impact on them than on the nonpoor.

4.2. The Influence of Social Capital

Social capital plays a role in increasing food expenditure, as shown by comparing the condition of the influence of food expenditure where social capital exists and non-exist in Table 5, columns 1 and 2. Comparison of Table 5 columns 1 and 3 show when social capital is non-existent, households who experience disasters will face a lower standard of living measured by lower food expenditure compared to others who do not experience disasters. When social capital exists, it helps households to have higher food expenditure after disasters are experienced compared to other households where social capital does not exist (Table 5, columns 3 and 4).

The role of social capital is found by other studies that found its importance in helping victims in recovery from natural disasters (Aldrich, 2012; Bhandari, 2014; Weil et al., 2012). Ahmad and Sadaqat (2016) explained that social capital also positively impacts a household's welfare. Thus, social capital helps the victim recover and have better welfare post-disasters. Another study found that those who increased contact through bonding social ties (e.g.,

neighbours, friends, and co-workers living in the same community) had higher support rates after the disaster (Hsueh, 2019).

By looking at the disaster types, a volcanic eruption negatively and significantly affects household food expenditure. At the same time, other disasters that significantly and positively affect food expenditure are floods, windstorms, and forest fires. When social capital plays a role, the negative effect of volcanic eruption is reduced. On the other hand, the existence of social capital may reduce the positive contribution of those three disasters. These conditions show social capital might reduce the risk of a household's vulnerability due to their inability to find food and the household's inability to face a sudden increase in food expenditure due to higher prices after disasters (Table 5 columns 3 and 4).

This finding is consistent with Rachmawati et al. (2017) who found the area's vulnerability to food security in the population after the eruption of Mt Kelud, Indonesia in 2014. Other studies found that social capital helps Indonesian families prepare emergency food commodities like bananas, sweet potatoes, and cassava as a source of carbohydrates, soybeans, and green beans as a source of protein (Ekafitri & Faradilla, 2011).

Table 5. The Impact of Natural Disasters on HH Food Expenditure

Variables	Impact on Poor and Nonpoor	Impact on Poor and Nonpoor	Impact on Poor and Nonpoor	Impact on Poor and Nonpoor	Impact on Poor	Impact on NonPoor	Impact on Poor	Impact on NonPoor
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Household size	-0.137*** (0.003)	-0.127*** (0.004)	-0.138*** (0.003)	-0.127*** (0.004)	-0.076*** (0.003)	-0.057*** (0.005)	-0.079*** (0.004)	-0.07*** (0.008)
Education	0.023*** (0.001)	0.019*** (0.001)	0.023*** (0.001)	0.019*** (0.001)	0.016*** (0.001)	0.004*** (0.001)	0.015*** (0.001)	0.004** (0.002)
HH head sex is male	-0.002 (0.011)	-0.006 (0.013)	-0.004 (0.011)	-0.008 (0.013)	0.002 (0.01)	-0.006 (0.016)	0.001 (0.012)	-0.004 (0.022)
Employment is agriculture	-0.189*** (0.013)	-0.163*** (0.015)	-0.186*** (0.013)	-0.162*** (0.015)	-0.111*** (0.012)	-0.075*** (0.024)	-0.109*** (0.014)	-0.079*** (0.03)
Trust: Willing to help		0.027** (0.014)		0.027** (0.014)			0.021* (0.012)	-0.015 (0.024)
Trust: Alert		-0.041*** (0.009)		-0.041*** (0.009)			-0.034*** (0.008)	-0.002 (0.016)
Trust: Same ethnicity		-0.069*** (0.009)		-0.069*** (0.009)			-0.042*** (0.008)	-0.032** (0.015)

Trust: Leave children	-0.034***	-0.034***			-0.025***	-0.008
	(0.01)	(0.01)			(0.009)	(0.017)
Trust: Look after the	0.014	0.013			0.018*	0.021
house	(0.011)	(0.011)			(0.01)	(0.017)
Flood	0.102***	0.072***	0.068***	0.031	0.057***	-0.021
	(0.019)	(0.021)	(0.017)	(0.025)	(0.019)	(0.031)
Landslide/mudslide	-0.039	0.026	-0.035	-0.085	0.01	-0.1
	(0.06)	(0.067)	(0.053)	(0.069)	(0.058)	(0.091)
Volcanic eruption	-0.169***	-0.147***	-0.113***	-0.042	-0.119***	-0.025
	(0.031)	(0.039)	(0.029)	(0.051)	(0.036)	(0.067)
Earthquake	0.004	0.002	0.02	0.02	-0.022	0.018
	(0.036)	(0.041)	(0.032)	(0.048)	(0.035)	(0.064)
Tsunami	0.055	0.106	0.091	0	0.228***	0
	(0.144)	(0.11)	(0.173)	(omitted)	(0.081)	(omitted)
Windstorm	0.058	0.106**	0.003	0.007	0.031	0.044
	(0.043)	(0.052)	(0.037)	(0.036)	(0.046)	(0.045)
Forest fire	0.363***	0.275**	0.345***	0.078	0.312***	0.133***
	(0.108)	(0.128)	(0.102)	(0.082)	(0.106)	(0.028)
Fire	0.085	0.012	0.093*	0.006	0.044	0.051
	(0.052)	(0.062)	(0.048)	(0.072)	(0.057)	(0.143)

Civil Strife			0.038	0.057	-0.066	0.118	-0.002	-0.014
			(0.124)	(0.12)	(0.118)	(0.092)	(0.111)	(0.075)
Drought			-0.045	-0.053	-0.009	0.316**	-0.03	0.171
			(0.049)	(0.058)	(0.042)	(0.165)	(0.052)	(0.212)
Constant	11.992***	12.185***	11.99***	12.183***	11.637***	12.873***	11.778***	13.018***
	(0.017)	(0.066)	(0.017)	(0.066)	(0.015)	(0.022)	(0.059)	(0.104)

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Dependent variable: Per capita food expenditure. The standard error is in parentheses. Source: analysed by authors

When observing poor and nonpoor households, we find natural disasters have a higher influence on the poor than the nonpoor, as shown by the coefficients that are higher in the poor, as shown in Table 5 columns 5 and 6. When social capital is non-exist, the poor are significantly affected by volcanic eruptions, floods, and forest fires. On the other hand, when social capital exists, poor households will have lower negative effects from volcanic eruptions and lower positive effects from floods, tsunamis, and forest fires.

In contrast to poor households, drought is the only disaster that (weakly) significantly influences food expenditure on nonpoor where social capital does not exist. When social capital plays a role, these households only receive a lower positive effect of forest fire on food expenditure. Therefore, social capital can support households to maintain the standard of living after disasters, with poor households having a bigger effect than nonpoor ones.

This finding is in line with prior studies that social capital in the form of trust, tolerance, social networks, and collective action can play a significant role in individual, local, and societal preparedness, response, and recovery from disasters (Brunie, 2007; Sadeka et al., 2015). Strong social capital (networking, trust, and norms among society) can contribute to speedier recoveries of communities affected by disasters (Hishida & Shaw, 2014).

Focusing on expenditures on food bought and own food production, natural disasters significantly affect expenditures on bought food than own food that is produced where social capital exists both for poor and nonpoor (Table 6).

Table 6. The effect of Natural Disasters on Food Expenditure of Food Bought and Own Production

	Impact of Food Bought on Poor	Impact of Food Own Produced on Poor	Impact of Food Bought on NonPoor	Impact of Food Own Produced on NonPoor
	(1)	(2)	(3)	(4)
Household size	-0.063*** (0.004)	-0.153*** (0.009)	-0.026** (0.012)	-0.207*** (0.034)
Education	0.019*** (0.001)	-0.002 (0.003)	0.007** (0.003)	-0.014* (0.007)

HH head sex is male	0.014 (0.015)	-0.044 (0.03)	0.033 (0.039)	0.026 (0.102)
Employment is				
agriculture	-0.2*** (0.017)	0.233*** (0.033)	-0.25*** (0.076)	0.052 (0.163)
Trust: Willing to help	0.016 (0.014)	0.008 (0.031)	-0.016 (0.032)	-0.012 (0.101)
Trust: Alert	-0.038*** (0.01)	-0.039* (0.021)	-0.002 (0.027)	-0.005 (0.071)
Trust: Same ethnicity	-0.052*** (0.01)	0.013 (0.021)	-0.06*** (0.023)	0.03 (0.066)
Trust: Leave children	-0.035*** (0.011)	-0.028 (0.023)	0.008 (0.03)	-0.04 (0.077)
Trust: Look after the				
house	0.01 (0.013)	0.083*** (0.027)	0.012 (0.026)	-0.004 (0.085)
Flood	0.06** (0.024)	0.028 (0.052)	-0.028 (0.051)	-0.05 (0.15)
Landslide/mudslide	0.019 (0.07)	0.068 (0.133)	-0.163 (0.13)	0.519 (0.317)
Volcanic eruption	-0.202*** (0.043)	0.3*** (0.073)	0.021 (0.1)	-0.144 (0.34)
Earthquake	-0.059 (0.041)	0.175* (0.093)	0.026 (0.082)	-0.096 (0.273)
Tsunami	0.107*** (0.026)	0.902*** (0.176)	0 (omitted)	0 (omitted)
Windstorm	0.016 (0.052)	0.289*** (0.098)	0.106* (0.054)	0.054 (0.254)
Forest fire	0.387*** (0.103)	0.244 (0.42)	0.266*** (0.039)	-0.045 (0.121)
Fire	0.041	0.073	0.201	-0.35

	(0.064)	(0.137)	(0.156)	(0.309)
Civil Strife	0.003	-0.161	-0.091	0.402
	(0.136)	(0.19)	(0.117)	(0.738)
Drought	-0.035	-0.004	0.173	0.558*
	(0.058)	(0.141)	(0.258)	(0.332)
Constant	11.58***	9.723***	12.717***	11.182***
	(0.069)	(0.151)	(0.14)	(0.474)

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Dependent variable: Per capita food expenditure. The standard error is in parentheses. Source: analysed by authors

It implies that households' dependency on buying food makes them vulnerable to price increases due to limited supply because of disasters, which may influence their ability to maintain their standard of living. Disasters frequently destruct infrastructure and supply chains, leading to commodity supply disruption and price increases. This finding is consistent with other research that observes the response of households to disasters through increasing food expenditure by approximately 20% and prefer to consume own-produced food commodities due to higher prices (Sulistyaningrum, 2015). Besides, Jakobsen (2012) found household expenditures for own produced food are reduced significantly due to windstorms but household expenditures for bought food are positive.

Table 7. The Influence of Natural Disaster with Clustered Standard Error

Variables	Kabupate		Kecamata
	Province	n	n
	(1)	(2)	(3)
Household size	-0.127*** (0.009)	-0.127*** (0.005)	-0.127*** (0.005)
Education	0.019*** (0.001)	0.019*** (0.001)	0.019*** (0.001)
HH head sex is male	-0.008 (0.019)	-0.008 (0.014)	-0.008 (0.013)
Employment is agriculture	-0.162***	-0.162***	-0.162***

	(0.027)	(0.021)	(0.018)
Trust: Willing to help	0.027*	0.027*	0.027**
	(0.014)	(0.015)	(0.014)
Trust: Alert	-0.041***	-0.041***	-0.041***
	(0.007)	(0.009)	(0.01)
Trust: Same ethnicity	-0.069***	-0.069***	-0.069***
	(0.014)	(0.012)	(0.01)
Trust: Leave children	-0.034***	-0.034***	-0.034***
	(0.011)	(0.01)	(0.01)
Trust: Look after the house	0.013	0.013	0.013
	(0.013)	(0.012)	(0.012)
Flood	0.072*	0.072**	0.072***
	(0.04)	(0.032)	(0.024)
Landslide/mudslide	0.026	0.026	0.026
	(0.067)	(0.062)	(0.062)
Volcanic eruption	-0.147*	-0.147**	-0.147***
	(0.075)	(0.057)	(0.052)
Earthquake	0.002	0.002	0.002
	(0.076)	(0.046)	(0.048)
Tsunami	0.106***	0.106***	0.106
	(0.034)	(0.022)	(0.112)
Windstorm	0.106	0.106	0.106
	(0.079)	(0.074)	(0.073)
Forest fire	0.275***	0.275**	0.275**
	(0.096)	(0.123)	(0.122)
Fire	0.012	0.012	0.012
	(0.079)	(0.061)	(0.062)
Civil Strife	0.057	0.057	0.057
	(0.134)	(0.116)	(0.118)
Drought	-0.053	-0.053	-0.053

	(0.052)	(0.052)	(0.059)
Constant	12.183***	12.183***	12.183***
	(0.124)	(0.079)	(0.068)

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Dependent variable: Per capita food expenditure. The standard error is in parentheses. Source: analysed by authors

Table 7 shows observation to examine the link between natural disasters and food expenditure with the influence of social capital should be conducted at the lowest administrative level, shown by higher accuracy of estimations when the analysis is on *kecamatan* (district) level instead of *kabupaten* (regency) or province. It implies that compared to the province or regency administrative levels, the development of social capital can contribute to households' living standards where it is conducted at the lowest administration level.

Since our findings above show the influence of natural disasters give a higher impact on the poor than the nonpoor, we use quantile regression to check the consistency of the need to focus on poor households (Table 8).

Table 8. Quantile Regression

	Deciles								
	1	2	3	4	5	6	7	8	9
Household size	-0.108*** (0.004)	-0.109*** (0.005)	-0.119*** (0.004)	-0.118*** (0.005)	-0.12*** (0.004)	-0.124*** (0.004)	-0.129*** (0.004)	-0.142*** (0.005)	-0.151*** (0.005)
Education	0.024*** (0.002)	0.021*** (0.002)	0.02*** (0.001)	0.019*** (0.001)	0.018*** (0.001)	0.016*** (0.001)	0.016*** (0.001)	0.016*** (0.002)	0.016*** (0.002)
HH head sex is male	0.001 (0.019)	0.014 (0.017)	0.012 (0.016)	-0.001 (0.017)	-0.001 (0.015)	-0.007 (0.016)	-0.015 (0.017)	-0.011 (0.019)	-0.03 (0.023)
Employment is									
agriculture	-0.12*** (0.027)	-0.114*** (0.019)	-0.148*** (0.016)	-0.159*** (0.018)	-0.155*** (0.017)	-0.168*** (0.019)	-0.171*** (0.018)	-0.202*** (0.022)	-0.191*** (0.024)
Trust: Willing to help	0.02 (0.02)	0.031* (0.018)	0.04** (0.016)	0.037** (0.015)	0.033** (0.015)	0.02 (0.015)	0.025 (0.018)	0.02 (0.018)	0.023 (0.021)
Trust: Alert	-0.035*** (0.013)	-0.019 (0.012)	-0.03*** (0.011)	-0.04*** (0.011)	-0.045*** (0.011)	-0.048*** (0.011)	-0.053*** (0.012)	-0.049*** (0.013)	-0.046*** (0.015)
Trust: Same ethnicity	-0.059*** (0.014)	-0.054*** (0.013)	-0.054*** (0.011)	-0.058*** (0.011)	-0.078*** (0.011)	-0.07*** (0.011)	-0.076*** (0.012)	-0.075*** (0.013)	-0.077*** (0.015)
Trust: Leave children	-0.033** (0.015)	-0.028** (0.014)	-0.024* (0.013)	-0.024** (0.012)	-0.028** (0.012)	-0.039*** (0.012)	-0.037*** (0.013)	-0.035** (0.015)	-0.043*** (0.015)

Trust: Look after the									
house	0.051***	0.008	0.006	0.015	0.016	0.008	0.013	0.008	0.001
	(0.018)	(0.016)	(0.014)	(0.013)	(0.013)	(0.014)	(0.015)	(0.016)	(0.018)
Flood	0.121***	0.077***	0.066**	0.075***	0.066**	0.069***	0.077***	0.064**	0.065**
	(0.034)	(0.025)	(0.031)	(0.022)	(0.026)	(0.03)	(0.027)	(0.029)	(0.031)
Landslide/mudslide	0.027	-0.086	-0.004	0.004	0.015	0.05	0.094	0.067	0.017
	(0.073)	(0.081)	(0.066)	(0.053)	(0.131)	(0.114)	(0.069)	(0.093)	(0.115)
Volcanic eruption	-0.121*	-0.185***	-0.168***	-0.181***	-0.145***	-0.138***	-0.085	-0.075	-0.077
	(0.072)	(0.043)	(0.04)	(0.052)	(0.049)	(0.051)	(0.064)	(0.067)	(0.075)
Earthquake	-0.008	0.032	-0.007	-0.023	0.006	-0.017	0.048	-0.029	0.031
	(0.043)	(0.058)	(0.027)	(0.063)	(0.053)	(0.05)	(0.063)	(0.05)	(0.061)
Tsunami	0.659	0.469	0.28	0.111***	-0.029	0.111	-0.042	-0.235	-0.507
	(0.988)	(0.312)	(.)	(0.042)	(1.164)	(.)	(.)	(0.145)	(.)
Windstorm	-0.022	-0.004	0.077	0.139*	0.125***	0.119**	0.167**	0.235***	0.216***
	(0.083)	(0.108)	(0.07)	(0.081)	(0.048)	(0.05)	(0.07)	(0.052)	(0.038)
Forest fire	0.409***	0.331***	0.291***	0.261	0.347	0.25***	0.147	0.01	0.104
	(0.038)	(0.036)	(0.055)	(0.178)	(0.4)	(0.039)	(0.096)	(0.034)	(0.155)
Fire	0.088***	-0.009	0.014	0.083	0.045	0.071	0.027	-0.032	-0.081
	(0.02)	(0.128)	(0.084)	(0.075)	(0.077)	(0.102)	(0.051)	(0.064)	(0.077)
Civil Strife	-0.028	-0.117	0.056	0.029	0.16	0.176	0.192	0.209	0.179***

	(0.266)	(0.275)	(0.313)	(0.121)	(0.211)	(0.127)	(0.256)	(0.153)	(0.028)
Drought	-0.157	-0.123	-0.078	0.017	0.037	0.001	-0.022	-0.072**	-0.09
	(0.118)	(0.104)	(0.059)	(0.146)	(0.044)	(0.051)	(0.05)	(0.036)	(0.135)
Constant	11.171***	11.495***	11.717***	11.888***	12.14***	12.399***	12.569***	12.843***	13.185***
	(0.094)	(0.086)	(0.078)	(0.075)	(0.075)	(0.076)	(0.084)	(0.089)	(0.103)

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Dependent variable: Per capita food expenditure. The standard error is in parentheses. Source: analysed by the authors

By using quantile regression in Table 8, the influence of natural disasters on the poor is higher than on the nonpoor, shown by higher coefficients in lower deciles than their counterparts in higher deciles. It implies the consistency of findings in Tables 5 and 8, driving the need to focus on poor households in maintaining their standard of living measured from food expenditure to dealing with natural disasters.

The need to focus on the development of social capital among the poor households is also raised by other studies which found bonding capital, i.e., the relationship between family and relatives, is the main asset of the poor, while bridging capital, i.e., the relationship between and neighbours is employed effectively by the non-poor, implying they would have different effects on community development (Adger, 2010). Then, bonding social capital played a crucial role throughout the recovery phases; bridging social capital only becomes important in long-term recovery (Nguyen-Trung et al., 2020).

Social capital can also be critical for communities to survive until outside help arrives during a disaster. It is often the only resource at communities can mobilise to respond and find themselves. Further, networking at the community level, especially in remote and hazardous areas is very important as it acts like informal insurance for households (Sanyal & Routray, 2016). Therefore, strong leadership to strengthen social capital in creating a common voice is needed, which is in the form of the post-disaster planning process (Nakagawa & Shaw, 2004).

Since focus should be aimed at the poor, some policy implications can be achieved. First, we need to increase the household standard of living, i.e., measured from the increasing food expenditure, so poor households have a financial buffer to deal with financial shocks like natural disasters. Second, we need to enhance social participation among the poor households and at the lowest administration levels as they can give have a higher impact than household classes.

Conclusions

This research presents a compelling examination of the profound impact of natural disasters on households, particularly in the context of their living standards, gauged through food expenditure. The evidence put forth underscores a stark reality: vulnerable households, often belonging to the economically disadvantaged strata of society, bear a disproportionately

heavier burden in the wake of natural disasters. However, the study also unveils a beacon of hope—social capital emerges as a powerful and resolute ally, significantly fortifying households in their struggle to maintain their living standards amidst adversity. This revelation accentuates the vital and unequivocal importance of fostering social capital as a paramount strategy for bolstering disaster resilience and safeguarding the well-being of vulnerable populations.

Policy recommendations should be focused on increasing the household standard of living so households have a financial buffer to deal with financial shocks like natural disasters. Besides, increasing social participation for the poor and at the lowest administration level is required to create a stronger social capital. Further analysis of the role of social capital within the smallest administration level might be interesting for other researchers for future studies.

References

- Adger, W. N. (2010). Social capital, collective action, and adaptation to climate change. In *Der klimawandel* (pp. 327-345): Springer.
- Ahmad, N., & Sadaqat, M. (2016). Social capital household welfare and poverty: Evidence from Pakistan. *The Pakistan Development Review*, 467-482.
- Aldrich, D. P. (2012). Social capital in post disaster recovery: towards a resilient and compassionate East Asian community. *Economic and welfare impacts of disasters in East Asia and policy responses*, 157-178.
- Arouri, M., Nguyen, C., & Youssef, A. B. (2015). Natural disasters, household welfare, and resilience: evidence from rural Vietnam. *World Development*, 70, 59-77.
- Badan Nasional Penanggulangan Bencana. (2022). Korban dan Kerusakan Menurut Bencana. Retrieved from <https://dibi.bnpb.go.id/kbencana/index>
- Badan Pusat Statistik. (2016). Garis Kemiskinan Makanan (Rupiah/Kapita/Bulan) Menurut Provinsi dan Daerah 2015-2016. Retrieved from <https://www.bps.go.id/indicator/23/505/4/garis-kemiskinan-makanan-rupiah-kapita-bulan-menurut-provinsi-dan-daerah.html>
- Benson, C. (1997). *The Economic Impact of Natural Disasters in Viet Nam*. Retrieved from Portland House, Stag Place, London: <https://cdn.odi.org/media/documents/7024.pdf>

- Bhandari, R. B. (2014). Social capital in disaster risk management; a case study of social capital mobilization following the 1934 Kathmandu Valley earthquake in Nepal. *Disaster Prevention and Management*.
- Brunie, A. (2007). *Household disaster preparedness: assessing the importance of relational and community social capital*: The University of North Carolina at Chapel Hill.
- Dartanto, T. (2022). Natural disasters, mitigation and household welfare in Indonesia: Evidence from a large-scale longitudinal survey. *Cogent Economics & Finance*, 10(1), 2037250. doi:10.1080/23322039.2022.2037250
- De Haen, H., & Hemrich, G. (2007). The economics of natural disasters: Implications and challenges for food security. *Agricultural economics*, 37, 31-45.
- Ekafitri, R., & Faradilla, R. F. (2011). Pemanfaatan komoditas lokal sebagai bahan baku pangan darurat. *Jurnal Pangan*, 20(2), 153-162.
- Fothergill, A., & Peek, L. A. (2004). Poverty and disasters in the United States: A review of recent sociological findings. *Natural hazards*, 32(1), 89-110.
- Grootaert, G., Narayan, D., Nyhan Jones, V., & Woolcock, M. (2004). *Measuring Social Capital : An Integrated Questionnaire*. Retrieved from Washington, DC: <https://openknowledge.worldbank.org/handle/10986/15033>
- Hishida, N., & Shaw, R. (2014). Social capital in disaster recovery in Japan: An overview. *Community practices for disaster risk reduction in Japan*, 51-62.
- Hsueh, H.-Y. (2019). The role of household social capital in post-disaster recovery: An empirical study in Japan. *International journal of disaster risk reduction*, 39, 101199.
- Jakobsen, K. T. (2012). In the eye of the storm—The welfare impacts of a hurricane. *World Development*, 40(12), 2578-2589.
- James, H. (2014). *Religion, Disaster Relief and Reconstruction in the Burmese Delta after Cyclone Nargis: How can disaster foster enhanced social capital, community empowerment, and socio-political transformation?* Retrieved from
- Jones, B. F., & Olken, B. A. (2010). Climate shocks and exports. *American economic review*, 100(2), 454-459.
- Jovita, H. D., Nashir, H., Mutiarin, D., Moner, Y., & Nurmandi, A. (2019). Social capital and disasters: How does social capital shape post-disaster conditions in the Philippines? *Journal of Human Behavior in the Social Environment*, 29(4), 519-534.

- Koenker, R., & Bassett Jr, G. (1978). Regression quantiles. *Econometrica*, 46(1), 33-50.
- Lal, P. N., Lal, P. N., Singh, R., & Holland, P. (2009). *Relationship between natural disasters and poverty: a Fiji case study*: SOPAC.
- Lindell, M. K., & Prater, C. S. (2003). Assessing community impacts of natural disasters. *Natural hazards review*, 4(4), 176-185.
- Ludwig, F., van Scheltinga, C. T., Verhagen, J., Kruijt, B., van Ierland, E., Dellink, R., . . . de Bruin, K. (2007). Climate change impacts on developing countries-EU accountability.
- Machalek, R., & Martin, M. W. (2015). Sociobiology and Sociology: A New Synthesis. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences (Second Edition)* (pp. 892-898). Oxford: Elsevier.
- MacRae, G., & Hodgkin, D. (2011). Half full or half empty? Shelter after the Jogjakarta earthquake. *Disasters*, 35(1), 243-267.
- Miyaguchi, T., & Shaw, R. (2007). Corporate Community Interface in Disaster Management – A Preliminary Study of Mumbai, India. *Risk Management*, 9, 209-222.
doi:10.1057/palgrave.rm.8250036
- Morton, J. F. (2007). The impact of climate change on smallholder and subsistence agriculture. *Proceedings of the national academy of sciences*, 104(50), 19680-19685.
- Murphy, D. J. (2011). Going on otor: Disaster, mobility, and the political ecology of vulnerability in Uguumur, Mongolia.
- Nadaamist, D. (2022). *Pengaruh Pembangunan Ekonomi dan Determinan Lainnya Terhadap Dampak Bencana Alam: Kasus Indonesia Tahun 2013-2019*. IPB University,
- Nakagawa, Y., & Shaw, R. (2004). *Social capital and disaster recovery: a comparative case study of Kobe and Gujarat earthquake*. Paper presented at the 13th World Conference on Earthquake Engineering, Vancouver, BC, Canada.
- Nguyen-Trung, K., Forbes-Mewett, H., & Arunachalam, D. (2020). Social support from bonding and bridging relationships in disaster recovery: Findings from a slow-onset disaster. *International journal of disaster risk reduction*, 46, 101501.
- Nosratabadi, S., Khazami, N., Abdallah, M. B., Lackner, Z., S. Band, S., Mosavi, A., & Mako, C. (2020). Social capital contributions to food security: A comprehensive literature review. *Foods*, 9(11), 1650.

- Nugroho, T. W., Hanani, N., Toiba, H., & Sujarwo, S. (2022). Does Social Capital Improve Food Security? Evidence from the Indonesian Family Life Survey. *Asian Journal of Agriculture and Rural Development*, 12(2), 138-147.
- Panwar, V., & Sen, S. (2018). Economic Impact of Natural Disasters: An Empirical Re-examination. *Margin: The Journal of Applied Economic Research*, 13(1), 109-139. doi:10.1177/0973801018800087
- Paterson, R. R. M., Kumar, L., Taylor, S., & Lima, N. (2015). Future climate effects on suitability for growth of oil palms in Malaysia and Indonesia. *Scientific reports*, 5(1), 1-11.
- Pelling, M., Özerdem, A., & Barakat, S. (2002). The macro-economic impact of disasters. *Progress in Development Studies*, 2(4), 283-305.
- Pierre-Louis, F. (2011). Earthquakes, nongovernmental organizations, and governance in Haiti. *Journal of Black Studies*, 42(2), 186-202.
- Putnam, R. D. (2000). *Bowling alone: The collapse and revival of American community*: Simon and schuster.
- Rachmawati, T. A., Hidayat, A. R. T., Wahyuningtyas, L., & Rachmansyah, A. (2017). *The impact of Kelud Volcano eruption to food security case study: Ngantang district, Malang Regencys*. Paper presented at the AIP Conference Proceedings.
- Sadeka, S., Mohamad, M. S., Reza, M. I. H., Manap, J., & Sarkar, K. (2015). *Social Capital and Disaster Preparedness: Conceptual Framework and Linkage*.
- Sanyal, S., & Routray, J. K. (2016). Social capital for disaster risk reduction and management with empirical evidences from Sundarbans of India. *International journal of disaster risk reduction*, 19, 101-111.
- Shaw, R., & Goda, K. (2004). From disaster to sustainable civil society: the Kobe experience. *Disasters*, 28(1), 16-40.
- Soseco, T. (2021). Household Size, Education, and Household Wealth in Indonesia: Evidence from Quantile Regression. *Jurnal Ekonomi Indonesia*, 10(3), 281-297.
- Sulistyaningrum, E. (2015). Household Expenditure in Response to Natural Disasters. *Journal of Indonesian Economy and Business (JIEB)*, 30(3), 257-272.

- Szreter, S., & Woolcock, M. (2004). Health by association? Social capital, social theory, and the political economy of public health. *International journal of epidemiology*, 33(4), 650-667.
- United Nations. (2016). Economic Recovery after Natural Disasters. *Humanitarian Action: A Shared Responsibility*, LIII. Retrieved from <https://www.un.org/en/chronicle/article/economic-recovery-after-natural-disasters#:~:text=The%20economic%20damage%20caused%20by,education%20infrastucture%20that%20disrupts%20schooling>.
- Weil, F., Lee, M. R., & Shihadeh, E. S. (2012). The burdens of social capital: How socially-involved people dealt with stress after Hurricane Katrina. *Social Science Research*, 41(1), 110-119.
- Woolcock, M., & Narayan, D. (2000). Social capital: Implications for development theory, research, and policy. *The World Bank Research Observer*, 15(2), 225-249.