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Research article

The Impact of Resilience on Household Food Insecurity in Indonesia

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Abstract: This study aims to determine the impact of resilience on household food insecurity in Indonesia. This study uses data from the National Socio-Economic Survey (Susenas) and Village Potential Data Collection (Podes) in 2018. The resilience variabel is a latent variabel in the form of a score formed from the pillars of access to basic services, adaptive capacity, assets, and social safety nets. Meanwhile, the food insecurity variabel is approached by the Rasch Scale and Raw Score based on the Food Insecurity Experience Scale (FIES). Estimation of the resilience score was carried out using factor analysis and Structural Equation Model (SEM). After estimating the resilience score, estimation using instrument variabels with the Two Stage Least Square (2SLS) method was carried out to determine the causal relationship between resilience and food insecurity. The number of community protection units (linmas) in residential villages is used as instrumental variable as a form of institutional quality approach. The results showed that the higher the level of resilience, the lower the level of household food insecurity. An increase in the resilience score by 1 unit will reduce the level of food insecurity by 0.733 units. The role of resilience in reducing food insecurity is quite large, around 22.212 relative to the average Rasch Scale of all observations.

Keywords: Food insecurity, resilience, instrumental variable, structural equation model

JEL Classification: D10, Q18, O53

Abstrak: Penelitian ini bertujuan untuk mengetahui pengaruh resiliensi terhadap kerawanan pangan rumah tangga di Indonesia. Studi ini menggunakan data Survei Sosial Ekonomi Nasional (Susenas) dan Pendataan Potensi Desa (Podes) tahun 2018. Variabel resiliensi merupakan variabel laten berbentuk skor yang dibentuk dari pilar akses ke pelayanan dasar, kapasitas adaptif, aset, dan jaring pengaman sosial. Sementara variabel kerawanan pangan didekati dengan Rasch Scale dan Raw Score berdasarkan *Food Insecurity Experience Scale* (FIES). Estimasi skor resiliensi dilakukan menggunakan analisis faktor dan *Structural Equation Model* (SEM). Setelah melakukan estimasi skor resiliensi, estimasi menggunakan variabel instrumen dengan metode Two Stage Least Square (2SLS) dilakukan untuk mengetahui hubungan kausalitas antara resiliensi dan kerawanan pangan. Variabel instrumen yang digunakan adalah jumlah satuan perlindungan masyarakat di desa rumah tangga tinggal sebagai salah satu bentuk pendekatan kualitas institusi. Hasil penelitian menunjukkan bahwa semakin tinggi tingkat resiliensi maka semakin rendah tingkat kerawanan pangan rumah tangga. Peningkatan skor resiliensi sebesar 1 satuan akan menurunkan tingkat kerawanan pangan sebesar 0,733 satuan. Peran resiliensi dalam mengurangi kerawanan pangan cukup besar yaitu sebesar 22,212 relatif terhadap rata-rata Rasch Scale seluruh observasi.

Kata Kunci: Kerawanan pangan, resiliensi, variabel instrument, structural equation model.

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1. INTRODUCTION

Food insecurity is a major problem in most countries in the world. In 2019, around 750 million people in the world experienced severe food insecurity and the trend has increased consistently since 2014 (FAO, 2020). According to FAO, if this trend continues, by 2030, more than 840 million people in the world or about 9.8% of the total population will experience hunger, even without considering the impact of the current Covid-19 pandemic that is currently happening. This condition indicates that the goals of the global development agenda stated in the Sustainable Development Goals (SDGs) to eliminate hunger and achieve food security and nutrition by 2030 will be difficult to achieve. Food insecurity - even less severe - can worsen the quality of food, increasing the risk of malnutrition, both undernutrition and obesity, chronic diseases, disruption of mental health and even decreased levels of well-being (FAO, 2020; Grafton and Dean, 2017; Saint Ville et al., 2019).

The level of food insecurity in Indonesia is still high. in 2019, 76 out of 514 districts/cities in Indonesia were vulnerable to food insecurity (Food Security Agency, 2018). Based on the 2019 Global Hunger Index, Indonesia ranked 70 out of 117 countries and is still in a serious category. Although the hunger index in Indonesia continues to decline, when compared to other countries in Southeast Asia, Indonesia's hunger index is still relatively high. Inequality in food access caused by poverty and lack of infrastructure as well as high food prices, where rice prices are 50-70% more expensive than neighbour countries, resulted in 19.4 million Indonesians unable to meet their food needs (WFP Indonesia, 2020). Meanwhile, based on the 2019 Global Food Security Index (GFSI), Indonesia is ranked 62nd out of 113 countries. GFSI is an index that measures food security comprehensively from 3 (three) main aspects, namely availability, affordability, quality and food safety as well as adjustment factors in the form of natural resources and resilience aspects. However, if only seen from the aspects of natural resources and resilience, Indonesia is ranked 110 out of 113 countries (Food Security Information Network, 2020). This aspect indicates that the availability, affordability, quality and safety aspects of food in Indonesia are quite good, but the natural resources and resilience aspects are still very poor.

Resilience in food systems can be a solution for food security (Ansah et al., 2019; Vaitla et al., 2020). It is the ability of individuals, households, communities, countries or regions to survive, adapt and recover quickly after stresses and shocks (EU, 2020). Shocks can be idiosyncratic shocks, such as the death of a household member and the illness of a household member, or covariate shocks, such as high food prices, weather changes and natural disasters. Results from empirical research show that resilience is able to enlarge the ability of households to cope with various shocks so that household food security is not adversely affected (Ansah et al., 2019). An understanding of resilience in household food systems can help develop better intervention programs in regions or countries prone to shocks.

The concept of resilience is currently an important concern in the development process (Béné et al., 2014; Fischer, A., & McKee, A., 2017). Many United Nations (UN) agencies, development, governmental, non-governmental and aid organizations consider resilience an important concept in understanding how households cope with shocks and stresses, and have tried to incorporate it into their program planning and targeting activities (FAO, 2016). Resilience building is a long-term endeavor that needs to be firmly embedded in every national policy and plan (EU, 2020). Building resilience to food security shocks is one of the development agendas in Indonesia to help vulnerable households maintain their welfare levels (WFP Indonesia, 2020). Resilience is a complex concept that cannot be determined by measuring only one indicator (d'Errico & Pietrelli, 2017). The multidimensional concept of resilience requires the government to be precise in determining the interventions to be provided.

The results of empirical studies on the relationship between resilience and food insecurity tend to show similar results where resilience is negatively related to food insecurity. In addition, resilience is also proven to reduce the adverse impact of shocks on food insecurity (Smith & Frankenberger, 2018). However, the complex concepts of resilience and food insecurity led to the diversity in measurements and estimations in previous studies. In terms of food security, some of

the approaches that have been used previously to measure food security include expenditure on food consumption (Brück et al., 2019; Ciani & Romano, 2014; FAO, 2016), number of months of adequate food (Smith & Frankenberger, 2018), dietary diversity (d'Errico et al., 2018; FAO, 2016) and calorie intake (d'Errico et al., 2018). Although these approaches are commonly used in measuring food security, they are indirect measures that are used as a form of proxy to describe the level of household food security.

Empirical testing to obtain a causal relationship between resilience and food insecurity must consider the endogeneity issues. Endogeneity problems that are not properly addressed will give biased estimation results. Ansah et al., (2019) explained that there is a reverse causality relationship between resilience and food security. Households that have a better level of resilience in overcoming shocks tend to have a better level of food security than households with a lower level of resilience. However, the more food resilient a household is, the better it is to determine strategies to maintain its level of resilience when facing shocks. Although several studies have mentioned the potential endogeneity that may occur in studies related to the impact of resilience on food insecurity (Ansah et al., 2019; d'Errico et al., 2018; Smith & Frankenberger, 2018), very few studies have addressed this issue in the estimation process. (Smith and Frankenberger, 2018) used the panel fixed effects method as a solution to overcome the endogeneity problem.

This study aims to determine the impact of resilience on household food insecurity in Indonesia after a natural disaster. It is an important issue along with climate change and predictions of increasing natural disaster events that will greatly affect Indonesia as a country prone to disasters. Indonesia is one of the country's most prone to natural disasters because it is located in the ring of fire (BNPB, 2018). Natural disasters are a major factor in transient food insecurity in Indonesia (Food Security Agency, 2018). Based on data from the National Disaster Management Agency (BNPB), there have been an average of around 2,000 natural disasters each year in Indonesia in the last ten years. The impact of natural disasters on households depends on the level of household resilience (Arouri et al., 2015). The high likelihood of natural disasters and their impact on household food insecurity makes an understanding of resilience absolutely necessary. Empirical studies on the impact of natural disasters on food insecurity have been conducted in Indonesia (Murniati, 2020), but studies on the impact of resilience on food insecurity have not been conducted yet.

The current Covid-19 pandemic is one form of shocks that has a major impact on food insecurity. The results of a survey conducted by Abdul Latif Jameel Poverty Action Lab (J-PAL) Southeast Asia since the end of March 2020 show that the level of food insecurity in Indonesia is getting higher due to the Covid-19 pandemic. The second week of the survey found that only 23% of households were able to consume the same amount of food as usual during the past week and the remaining 77% consumed less food than usual. Meanwhile, 36% of households often consume less food than usual due to financial constraints (Hanna & Olken, 2020). The magnitude of the impact of the Covid-19 pandemic on Indonesian households makes the role of resilience even more important. This research is expected to serve as a basis for further research to determine the role of resilience to food insecurity in the face of the Covid-19 pandemic in Indonesia.

The contribution of this research consists of at least three aspects. First, this study attempts to measure the impact of resilience on household food insecurity in Indonesia following natural disasters. The literature on the impact of resilience on food insecurity is still very limited, and has never been done before in Indonesia. This limitation may be due to the difficulty in finding proxies in measuring resilience which is multidimensional. This study tries to provide an alternative in measuring resilience based on indicators from available data so that it can be used as a basis for further research. Second, the use of the Food Insecurity Experience Scale (FIES) to measure food insecurity in studies related to the impact of resilience on food insecurity has never been done before. FIES is a new global standard that is valid in measuring food insecurity, its use is approved at the international level, the results can be compared between countries, and can be used for monitoring purposes at both the country and global levels (FAO, 2016). The FIES measures the severity of food insecurity based on individual or household responses to questions about constraints experienced in providing adequate food needs. The measurement of food insecurity

using the FIES represents a significant change from previously commonly used approaches to measuring food insecurity, which were indirectly measured, such as food consumption expenditure, calorie intake, or dietary diversity (FAO, 2016).

According to FAO, the use of the FIES is better than other approaches in measuring food insecurity at least because the FIES asks respondents directly about their food insecurity experiences, ease of use and administration, timeliness of reporting, ability to describe the severity of food insecurity by distinguishing between severity levels, and providing actionable information for policymakers. In addition, the use of the FIES in measuring food insecurity in Indonesia is still very limited because the data is only available in the National Socio-Economic Survey (Susenas) from 2017. Third, this study also attempts to resolve the endogeneity problem that occurs in measuring the impact of resilience on food insecurity by using instrument variables. As explained in the background section, although some previous studies have mentioned the potential endogeneity that may occur, very few studies have addressed this issue. (Smith and Frankenberger, 2018) used panel fixed effects to overcome the endogeneity problem. Although panel data can be used to control for time-invariant unobserved households, the use of panel data does not fully solve endogeneity problems that occur such as measurement error, reverse causality, or omitted variable bias. Therefore, this study tries to use instrument variables to overcome the problems of measurement error, reverse causality, and omitted variable bias that occur in this study.

2. RESEARCH METHODS

2.1. Data

The data sources used in this study are a combination of the National Socio-Economic Survey (Susenas) and the 2018 Village Potential Data Collection (Podes) from the Central Statistics Agency (BPS). Susenas is the national-scale data presenting information on the socioeconomic characteristics of households. Meanwhile, Podes is the census data at the village level and equivalent levels, presenting information on natural disasters, socio-economic potential, infrastructure conditions, and other crucial information. The susenas and Podes data were combined using village id to determine the unit of analysis of the study, namely households affected by natural disasters in 2017 and obtain comprehensive information in analyzing the impact of resilience on food insecurity. In the Susenas, there was no information on whether households were affected by natural disasters or not, so an approach was taken through the villages where the Susenas sample households lived that were affected by disasters or not through the 2018 Podes data collection. If the village where the Susenas sample households live is affected by a natural disaster, then it is assumed that the households living in that village are affected by the natural disaster.

In total, the number of observations used in this study was 121,676 households. Price increases are one of the economic shocks that may affect food insecurity. Data on price increases/inflation is only available at the city level. Therefore, researchers used another approach to determine the shock of price increases by using price data for 20 main food commodities to calculate the price increase/inflation experienced by households at the district/city level (Anwar, 2020).

The dependent variable used in this study is food insecurity, approached with Raw Score and Rasch Scale. Household food insecurity is a condition where households do not have access both physically (availability) and economically (purchasing power) to obtain food in quantity, quality, variety, and safety to meet their physiological conditions (Food Security Agency, 2018). The measurement of food insecurity used in this study is through the Food Insecurity Experience Scale (FIES) contained in the access to food block for the past year in Susenas. The access to food block consists of 8 (eight) questions regarding the experience of food insecurity experienced by households ranging from food sufficiency, healthy food, types of food consumed, skipping meals, eating less, running out of food, starvation, and even not eating all day which describes the process of food insecurity and hunger. The purpose of the questions in this block is to estimate the

prevalence of food insecurity experienced by households. There are two approaches to measuring food insecurity, namely the raw score (the FIES value is obtained by summing the entries of the 8 questions contained in the access to food block) and the Rasch scale (the FIES value is obtained using the IRT method, namely the Rasch model). Higher Raw Score and Rasch Scale values indicate higher level of food insecurity.

The resilience variable is a latent variable consisting of several pillars/dimensions which are also latent. The resilience dimensions used in this study are Access to Basic Services, assets, adaptability, and social protection guarantees. The resilience variable will be a resilience score, a combination of the four dimensions, where higher resilience score indicates better resilience of the household. The initial assumption is that higher resilience possessed by households will have a negative impact on food insecurity.

Table 1. The access to basic services dimension, the asset dimension, the adaptive capacity dimension, and the social safety net dimension

Variable	Indicator
Educational facilities	Number of primary schools, junior high schools, senior high schools, and universities in the village where the household lives
Health facilities	Number of hospitals, health centers, polyclinics, doctor's offices, and village health posts
Markets	The number of markets in a village
Toilet	Dummy variable with code 1 having a gooseneck toilet at home, 0 not
Electricity	Dummy variable with code 1 means the house is electrified, 0 not
Main water source	Dummy variable with code 1 means the house uses piped water, borehole/pump, or protected well, 0 does not
Quality Movement	The condition of roads in the village where households live, code 1 for roads passable by vehicles throughout the year, 0 not
Share of household members with health insurance	The number of household members with health insurance divided by the total household members.
Housing	Index that reflects housing prices, derived from indicators of home ownership and other housing and floor area
Land other than dwellings	Approximated by a dummy variable of 1 when owning land and 0 when not owning land
The Wealth Index	Approximated by a composite index of 11 dummy variables regarding ownership of refrigerators, air conditioners, water heaters, landlines, computers/laptops, gold, motorcycles, boats, motorboats, cars, and televisions.
Income diversification	The number of different sources of income in the household, approximated by the number of occupations of household members and the main source of financing other than employment (e.g. transfers, investments or pensions).
Average years of education	The average years of education (in years) of household members.
Income earners share	the number of active household members, more than 15 years old and less than 64 years old, divided by the total number of household members.
Rice for the Poor (Raskin) or Rice for the Prosperous (Rastra)	Dummy variable, code 1 if receiving assistance and code 0 if not
Non-cash food assistance (BPNT)	Dummy variable, coded 1 if receiving assistance and coded 0 if not.
Family Hope Program (PKH)	Dummy variable, coded 1 if receiving assistance and coded 0 if not.
Social Assistance from the regional government in the form of goods or money	Dummy variable, coded 1 if receiving assistance and coded 0 if not.

The diversity of conditions and infrastructure between islands may lead to different levels of resilience and food insecurity. Therefore, to accommodate these differences, island control will be used in the model with the classification of Sumatra, Java, Bali, Nusa Tenggara, Kalimantan, Sulawesi, Maluku, and Papua.

2.2. Resiliency Estimation

Resilience is a multidimensional variable that is unobservable. The FAO Resilience Index and Measurement Analysis (RIMA) framework, which was later updated to RIMA-II, uses factor analysis and SEM to form resilience variables using observable indicators. The same methodology was also used by d'Errico and Pietrelli (2017) to estimate resilience. This approach consists of two stages of estimation. In the first stage, factor analysis is used to estimate the score of each pillar that contributes to resilience, based on the observed variables described earlier. Factor analysis is a statistical method used to summarize data so that relationships and patterns can be more easily interpreted and understood (Yong & Pearce, 2013). In the second stage, SEM was used to estimate the resilience score for each household based on the pillars formed from the first stage estimation, with the following equation:

$$R_i = f(APD_i, AST_i, KA_i, JPS_i) \quad (1)$$

where, the resilience of the i-th household is a function of four pillars: access to basic services (APD), assets (AST), adaptive capacity (KA), and social safety net (JPS).

Factor analysis is also known as summarization or dimensionality reduction because measured and directly observed variables can be summarized into a smaller number of unobservable latent variables. Some of the benefits of using factor analysis methods according to Supranto (2016) include facilitating the processing of many variables by grouping these variables into factors that have the same properties or characteristics and making it easier to interpret the results. The procedure in factor analysis is to conduct a sample adequacy test using Kaiser Meyer Olkin (KMO) to determine whether factor analysis can be used, then extract variables to get the appropriate number of factors, and finally predict the latent score value based on the factors formed. If all variables are highly correlated, then there may be only one factor.

SEM is a combination of analysis and regression factors to examine the relationship between latent variables and observed variables. SEM allows researchers to simultaneously evaluate the interplay between latent variables, the influence of observed indicators on these latent variables, and the overall structure of the model (Wala et al., 2020). However, the SEM method is limited in that it can only be used for normally distributed data. Meanwhile, most of the data used in measuring resilience in this study is nominal data. Therefore, the first stage of estimation to obtain the resilience pillar score used factor analysis, then the second stage used SEM.

2.3. Model

The estimation method used is Simultaneous Equation with estimation using Two Stage Least Square (2SLS), and instrument variables. The purpose of using the 2SLS method in analyzing resilience capacity towards food insecurity is to overcome the endogeneity problem that occurs. Several studies mention that there is an endogeneity relationship between resilience and food insecurity (Ansah et al., 2019; Brück et al., 2019; Smith & Frankenberger, 2018). The OLS method is not appropriate for this study due to endogeneity issues, resulting in biased and inconsistent estimates.

Measuring the impact of resilience on food insecurity potentially raises endogeneity issues for at least three reasons. The first is the possibility of reverse causality between resilience variables and food insecurity. Households with better resilience in coping with shocks tend to have better food security than households with lower resilience. However, the more food resilient a household is, the better it is to determine strategies to maintain its level of resilience when facing shocks (Ansah et al., 2019). Second, the possibility of omitted variable bias due to the presence of factors affecting resilience and food insecurity that are not included in the model, such as household abilities and skills (d'Errico & Pietrelli, 2017). Third, the possibility of measurement error in measuring resilience (d'Errico & Pietrelli, 2017) due to the reduction process that occurs. The endogeneity problem, if not addressed, has the potential to produce biased and inconsistent estimates. The existence of omitted variables that are not included in the analysis of the relationship between resilience and food insecurity can make the estimates generated by OLS

downward biased. Also, the reduction of information in forming resilience variables will also trigger downward bias in OLS estimation.

Determining the right instrument variable to overcome the endogeneity problem is crucial. In their study on the impact of resilience on child malnutrition in Mali, d'Errico & Pietrelli (2017) used the number of technical services in each state as an instrument variable that was considered to have a strong effect on resilience. The number of technical services is a proxy for the institutional environment of the community where households live, which is an important factor in resilience (d'Errico & Pietrelli, 2017). Investments in disaster risk management and better institutional coordination are needed to reduce damage to assets and the economy (The World Bank, 2018), which is one of the building blocks of resilience. The ability of human resources to mitigate disasters in local authorities is one of the factors that influence resilience (Kusumastuti et al., 2014). Increasing the ability of the linmas unit is one way to increase resilience through the learning and adaptation paths (Ciptaningrum & Pamungkas, 2017). The more the number of linmas, the better the household's adaptation ability in facing disasters so that its resilience is also better. Regulation of the Minister of Home Affairs of the Republic of Indonesia number 84 of 2014 explains that the Community Protection Unit (Linmas) is an organization formed by the village government and consists of community members who are prepared and equipped with knowledge and skills to carry out disaster management activities to reduce and minimize the consequences of disasters, and participate in maintaining security, peace and order in the community and social community activities. Based on these regulations, it can be seen that the tasks and functions of the linmas are not directly related to food insecurity in a village, so the exclusion restriction assumption is fulfilled. Based on this literature, this study will use the number of security guards as a proxy for the quality of institutions in the area where households live, which has a direct effect on resilience and indirect effect on food insecurity.

The number of security guard variable in the place where households live is used as an instrument variable with the hope of reducing bias in estimating the relationship between resilience and food insecurity. An increase in the ability of the security forces will help households adapt more quickly when experiencing shocks so that household resilience increases. In this study, the linmas variable is assumed not to be directly related to food insecurity, because the task of the linmas is not directly related to food availability in the village but rather to increasing resilience through the adaptation process. Related to the assumption of exogeneity in determining a good IV, there is no specific rule that determines the number of security guards in a village. The use of Linmas as an instrument variable will be more valid if controlled by other covariates such as population, level of vulnerability to disasters or the number of crimes that may affect the determination of the number of Linmas in a village. This study has done this control by including the incidence of crime experienced by households so that it is expected that the IV used is valid. The estimation model used in this study is:

Second stage:

$$Y_i = c_i + \beta Resilience_i + \gamma X_i + u_i \quad (2)$$

First stage:

$$Resilience_i = \alpha_0 + \alpha_1 Z_i + \alpha_2 X_i + \varepsilon_i \quad (3)$$

Variable $\boldsymbol{Y}$ is the outcome of food insecurity level consisting of Raw Score and Rasch Scale. Raw Score is the result of the summation of answers from each FIES question item. Rasch Scale is the result of estimating the food insecurity score using the IRT method, namely the Rasch model. Resilience is the variable of interest. Variable $\boldsymbol{X}$ is a control variable in the form of a vector of household socioeconomic characteristics and other shocks experienced by households consisting of the number of natural disasters, gender of the household head, age of the household head, number of household members, housing status, and poverty status. Meanwhile, other shocks that are also used as control variables are price increases, debt or credit holdings, crime victims, and hospitalized households. **Z** is an instrumental variable in the form of the number of security guards in the village where the household lives. Subscript i indicates household i. β is the parameter for

the resilience variable, γ is the parameter for the household characteristics variable, and u is the error term, and the standard error is clustered at the village level to accommodate the possibility of correlation between households within the same village. Clustering standard error is done because the unit of analysis of this research is at the household level, while the instrument variable in the form of the number of linmas is at the village level.

3. RESULTS AND DISCUSSION

3.1. Resilience

Resilience is measured using four pillars, namely Access to Basic Services, Assets, Adaptive Capacity and Social Safety Net, where each pillar is composed of several indicators. The resilience score was estimated using factor analysis. Before estimating, a Kaiser-Meyer-Olkin (KMO) test was conducted for each pillar indicator, where the rule of thumb states that the KMO test value must be equal to or greater than 0.5 so that the indicator can be estimated using factor analysis. A KMO test value of less than 0.5 indicates that the indicators used have little in common so they will not cluster into certain factors. The resilience variable is in the form of a score, where a higher score indicates a better level of household resilience.

Table 2 shows the results of the resilience score estimation using SEM in the second stage. Indicators at the bottom of the table indicate good model fit. All coefficients of the resilience pillars show a positive and statistically significant relationship at the 1 percent level. These results are in line with the theory that access to basic services, assets, adaptive capacity, and social safety nets together will shape household resilience and are in line with the results of d'Errico et al., (2018) in Tanzania and Uganda. The latent variable resilience score is an unobserved variable, so it does not have a basic unit of measurement. However, to represent the resilience score value, a reference unit must be defined. Therefore, the coefficient of Access to Basic Services is not estimated but used as a reference. The estimation results show that the Social Safety Net pillar is the most relevant pillar to the resilience of households affected by natural disasters in Indonesia, followed by the adaptive capacity pillar.

Table 2. Results of resilience variable estimation using SEM

Resilience Pillars	
Acess to basic services	1
	(-)
Assets	0,1904***
	(0,0155)
Adaptive capacity	1,2279***
	(0,0231)
Social safety nests	2,0468***
	(0,0579)
Observations	121,676
Chi2	1213,631
p-value	0,0000
RMSEA	0,071
Pr RMSEA	0,0000
CFI	0,904
TLI	0,712

Note: Standard errors in parentheses, * $p < 0,1$, ** $p < 0,05$, *** $p < 0,01$

This result is slightly different from the research of d'Errico et al., (2018) in Tanzania and Uganda, where in both countries, it was the adaptive capacity pillar that was most relevant to

resilience, followed by the social safety net pillar. Social safety nets can increase resilience during shocks because they help, allowing households to increase their adaptive capacity (through asset accumulation or livelihood diversification) during normal conditions and protect households from poverty during shocks (Frankenberger et al., 2014). Besides, to increase resilience, it is necessary to increase assistance to households through social safety nets to help households acquire more resources and thus more assets (Gambo Boukary et al., 2016). The large role of social safety nets on resilience may be due to the provision of social safety nets as a stimulus to increase adaptive capacity and assets.

3.2. First Stage: Impact of Number of Community Protection Units on Resilience

Before discussing the regression results between resilience and food insecurity, the feasibility of the instrument variable needs to be evaluated first. The instrument variable used is the number of Linmas in a village. This instrument variable is used as a proxy for the quality of institutions where households live, which is an important factor of household resilience. Institutions are one of the important characteristics shaping a resilient system by allowing access and rights to assets that enhance resilience (IFAD, 2015). Table 3 shows the results of the first stage estimation between the number of community security guards and resilience. The coefficient estimate of the number of linmas is positive and statistically significant at the 1 percent level. This result indicates that the addition of one linmas person in the village where the household lives will increase the household resilience score by 0.001 units.

Table 3. First stage results

	Dependent Variable*:* Resilience	
	(1)	(2)
Linmas	0,002***	0,001***
	(0,000)	(0,000)
Household characteristics	No	Yes
Other Shocks	No	Yes
Island Dummy	No	Yes
K-P-F *statistic*	242,56	102,14
Adj, R-squared	0,0233	0,2030
Observations	121676	121676

Note: Standard errors in parentheses, * $p < 0,1$, ** $p < 0,05$, *** $p < 0,01$

This result is in accordance with study by Ciptaningrum & Pamungkas (2017) which states that increasing the ability of community protection units can increase resilience through learning and adaptation pathways. The number of public security guards is a non-weak and good instrument in explaining resilience, as evidenced by the Kleibergen-Paap (K-P-F statistic) value which reaches 102.14, far above the rule of thumb criteria or critical value from which must be greater than 10 to indicate that the instrument used is non-weak (Sanderson & Windmeijer, 2016).

3.3. Impact of Resilience on Food Insecurity

Table 4 shows the estimation results between resilience and food insecurity using OLS and Two Stage Least Square (2SLS) methods. The food insecurity indicators used in this study are Rasch Scale and Raw Score. The estimation results using OLS and 2SLS for both food insecurity indicators show the same direction that there is a negative relationship between resilience and food insecurity.

The estimation results using OLS produce a biased estimate because it has not overcome the endogeneity problem that occurs. The model specification using the 2SLS method is believed to be better than the estimation using OLS because it has eliminated the endogeneity problem between resilience and food insecurity by using an instrument variable in the form of the number of civil servants.

Table 4. Impact of resilience on household food insecurity

	Dependent Variable *: Raw Score*				*Dependent* Variable *: Rasch Scale*			
	OLS		2SLS		OLS		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Resilience	-1,515***	-1,181***	-4,031***	-0,937**	-0,856***	-0,666***	-2,250***	-0,733***
	(0,032)	(0,031)	(0,357)	(0,461)	(0,016)	(0,016)	(0,186)	(0,233)
Natural disaster		0,021***		0,022***		0,012***		0,011***
		(0,004)		(0,004)		(0,002)		(0,002)
Male household head		-0,200***		-0,207***		-0,092***		-0,090***
		(0,014)		(0,019)		(0,006)		(0,009)
Age of household head		-0,002***		-0,002***		-0,001***		-0,001***
		(0,000)		(0,000)		(0,000)		(0,000)
Number of households		0,004		0,006		0,004**		0,003*
		(0,003)		(0,004)		(0,002)		(0,002)
Poor		0,714***		0,740***		0,323***		0,315***
		(0,028)		(0,054)		(0,012)		(0,027)
Urban		-0,004		-0,041		-0,034***		-0,024
		(0,018)		(0,072)		(0,009)		(0,036)
Inflation		0,002***		0,002***		0,001***		0,001***
		(0,001)		(0,001)		(0,000)		(0,000)
Debt		-0,041***		-0,048***		-0,017***		-0,015*
		(0,011)		(0,018)		(0,006)		(0,009)
Crime		0,222***		0,222***		0,106***		0,106***
		(0,027)		(0,027)		(0,012)		(0,012)
Ill family member		0,063***		0,060***		0,025***		0,026***
		(0,013)		(0,014)		(0,006)		(0,007)
Island Dummy	No	Yes	No	Yes	No	Yes	No	Yes
F-*statistic*	2218,33	180,74	-	-	2978,17	245,52	-	-
K-P-F *statistic*	-	-	242,56	102,14	-	-	242,56	102,14
Observation	121676	121676	121676	121676	121676	121676	121676	121676

Note: Standard errors in parentheses * $p < 0,1$, ** $p < 0,05$, *** $p < 0,01$

The estimation results using 2SLS in column 4 shows that resilience is negatively related and statistically significant at the 1 percent level to food insecurity, both using the Raw Score (column 4) and Rasch Scale (column 8) approaches. An increase in resilience score by 1 unit will decrease the Raw Score by 0.937 units. In other words, the role of resilience is quite small in reducing food insecurity, which is 1.291 relative to the average Raw Score of all observations. In line with these results, estimation using Rasch Scale indicators also shows similar results. Column 8 shows that resilience is negatively related to food insecurity and significant at the 1 percent level. An increase in resilience score by 1 unit will decrease Rasch Scale by 0.733 units. Unlike the Raw Score, the role

of resilience is quite large relative to the average Rasch Scale of all observations, which is 22.212. These results further strengthen evidence from previous empirical research that higher level of household resilience will affect the decrease in the level of food insecurity. The results of Smith and Frankenberger's (2018) research in Bangladesh show that a 1 percent increase in the resilience index will increase food sufficiency months by 0.053 months. Meanwhile, the results of research by d'Errico and Pietrelli (2017) shows that a 1 unit increase in the resilience score will reduce the number of stunted children by 0.392.

The number of natural disasters has a positive and significant effect at the 1 percent level on food insecurity. The more natural disasters experienced by households, the higher the level of food insecurity of the household. This result is consistent with (Badan Ketahanan Pangan, 2018) that natural disasters are a cause of food insecurity in Indonesia. Natural disasters are associated with crop failures that will affect food availability. An increase in the number of disasters by 1 unit will increase the Rasch Scale by 0.011 units. This result is in accordance with the research of Smith and Frankenberger (2018) which states that the number of self-reported shocks experienced by households is negatively related to the number of months of food sufficiency. Every additional 1 self -reported shock will reduce the months of food sufficiency by 0.109 months.

Male household heads are more food secure than female household heads because male household heads have a higher chance of getting or cultivating work, so that the income earned will be more and will be better able to provide food needs for their household members. This result is consistent with Smith and Frankenberger's (2018) research in Bangladesh. The older the age of the household head, the more food secure the household is. This condition is because the older the age, the more experience gained in earning income and facing shocks that result in food insecurity. The results of this study are in accordance with the research of d'Errico & Pietrelli (2017).

The number of household members is positively and significantly related to food insecurity. The more the number of members in a household, the more the increase in demand for food. There will be more people who need food so that household members may not be able to get enough food to meet their needs. The results of this study are in accordance with the research of Alinovi et al., (2015), d'Errico & Pietrelli (2017), d'Errico et al., (2018) and Smith and Frankenberger (2018). Household poverty status is positively related to food insecurity. The less income the more food insecure the household is. An increase in income means greater access to food. The results of this study are consistent with Smith and Frankenberger (2018).

Food price increases are positively related to food insecurity. The increase in food prices will affect the purchasing power of households, resulting in food insecurity. This research is in accordance with Phami et al., (2020). Besides, Smith and Frankenberger (2018) also obtained similar results that economic shocks will increase food insecurity. Debt ownership is negatively and significantly related to food insecurity. The more the debt, the lower the level of food insecurity. This condition may be because the debt obtained can be used to buy food needs so that households do not experience food insecurity. In addition, debt ownership also allows households to use debt as capital to carry out other income-generating activities so that income will increase and can get out of food insecurity. This result is in accordance with research (Bidisha et al., 2017). The presence of household members who are victims of crime and hospitalization or illness is positively related to food insecurity because these shocks will increase household expenditure to overcome shocks such as buying medicine and paying for hospitals. This result is consistent with Phami et al., (2020) and Smith and Frankenberger (2018).

4. CONCLUSIONS

Natural disasters will affect the level of household food insecurity. The magnitude of the influence of natural disasters on household food insecurity will depend on the resilience of households. This study looks at the role of household resilience in reducing the impact on food insecurity after experiencing natural disasters. Resilience variables are formed from four pillars, namely access to basic services, assets, adaptive capacity, and social safety nets. The resilience estimation results show that the social safety net pillar is the most relevant pillar to household

resilience. The endogeneity problem that occurs in estimating the causal relationship between resilience and food insecurity is overcome by using an instrument variable in the form of the number of community protection units in the village where households live. After overcoming the endogeneity problem, consistent with previous studies, the estimation results show that household resilience has a negative effect on food insecurity.

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