JIAE Journal of Indonesian Applied Economics
VOL. 11 NO. 1 (2023)
ISSN : 2541-5395 (Online) 1907-7947 (Printed)
https://jiae.ub.ac.id/

THE EFFECT OF NATURAL DISASTER ON REGIONAL ECONOMIC GROWTH, UNEMPLOYMENT, POVERTY, AND HUMAN DEVELOPMENT INDEX IN THIRTY INDONESIAN PROVINCES

[1]Aulia Puja Ilham, [2]Sri Muljaningsih, [3]Sasongko
[1,2,3]Faculty of Economics and Business, Universitas Brawijaya, Indonesia

Corresponding author:
aulia.puja@yahoo.co.id

Abstract

Purpose
The objective of this research is to identify the effects of natural disasters on several variables. The impacts were analyzed both directly and indirectly.
Design/methodology/approach
Using Partial Least Squares, natural disaster, regional economic growth, poverty, unemployment, and human development index as the variables with their own indicators.
Findings
This study finds that the direct effects of natural disasters are a significant reduction in regional economic growth, an insignificant increase in poverty, and a significant increase in unemployment. Furthermore, natural disaster have varying results in indirect effects.
Research limitations/implications
The limitation of this research is the use of natural disasters which only involves three types of natural disasters, as well as thirty provinces in Indonesia.
Originality/value
This study uses regional economic growth, unemployment, and poverty variables as intervening variables to determine the effect of natural disasters on the human development index which there are still not many similar studies on the disaster economics approach.

Keywords: Natural Disaster, Regional Economic Growth, Poverty, Unemployment, Human Development Index.

HOW TO CITE

Ilham, A. P., Muljaningsih, S., & Sasongko. (2023). The Effect of Natural Disaster on Regional Economic Growth, Unemployment, Poverty, and Human Development Index in Thirty Indonesian Provinces. *Journal of Indonesian Applied Economics*, *11*(1), 40-59

DOI: doi.org/10.21776/ub.jiae.2023.011.01.4

ARTICLE HISTORY

Received : January 20, 2022
Published : February 28, 2023

1. INTRODUCTION

According to the United Nations International Strategy for Disaster Reduction (UNISDR), among all countries in the world, Indonesia is one of the countries most prone to natural disasters. Various natural disasters hit Indonesia such as whirlwinds, floods, earthquakes, volcanic eruptions, tsunamis, landslides, forest fires, and droughts that are prone to occur in Indonesia. The disasters that occurred resulted in property losses, human casualties, psychological impacts, and environmental damage, according to Law Number 24 of 2007. As well as the number of victims who died or were exposed to the population due to natural disasters for several types of natural disasters, the first rank was occupied by Indonesia (UNISDR).

Figure 1. Frequency of Disaster in Indonesia from 2013 to 2019

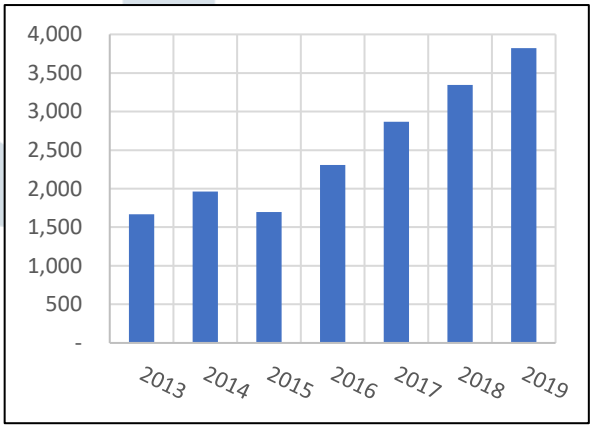
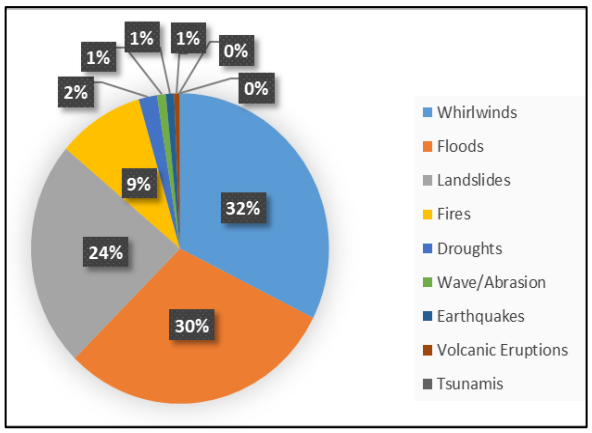


Figure 2. Natural Disaster Data in Indonesia from 2013 to 2019



Source: Badan Nasional Penanggulangan Bencana (BNPB), (2020)

Data compiled from Data Informasi Bencana Indonesia (DIBI) by Badan Nasional Penanggulangan Bencana (BNPB) of the Republic of Indonesia, shows that natural disasters that occur in Indonesia tend to increase every year. Dominated by whirlwinds, floods, and landslides with the highest intensity (DIBI BNPB), these disasters have direct impacts such as loss of life, and result in injuries, besides having an impact on humans, disasters that often come to Indonesia can also damage people and have an impact on assets such as houses and public facilities in Indonesia.

Various losses that occur as a result of a combination of natural disasters that hit can have an impact on household consumption due to adjustments made such as through the reconstruction carried out (Bui et al., 2014), as well as the disruption of planned investment plans, and from the government's perspective the damage caused by the disaster resulted in expenditures that needed to be channeled for rehabilitation and handling due to natural disasters that hit (Klomp & Valckx, 2014), where private consumption, investment, and government spending were components of Gross Domestic Product (GDP) excluding net exports (Prathama & Manurung, 2008).

An empirical study of natural disasters on the studied economy (Fomby et al., 2013) using data from 84 countries during the period 1960 to 2007 found that in developed countries the impact of natural disasters on economic growth was not significant, but significant and dependent on types of disasters for developing countries. In developing countries, disasters have the most detrimental impact on economic growth (Klomp & Valckx, 2014) catastrophic consequences not only affect the economy nationally but also regionally, (De Oliveira, 2019) showing that damage from environmental shocks depresses

GDP growth of economic cities to a lesser extent in the case of the state of Ceará, Northeast Brazil, further (Tope, 2019) in his research also stated that the growth of GRDP per capita of the Province of Central Sulawesi, Indonesia declined in 2018 due to natural disasters that hit.

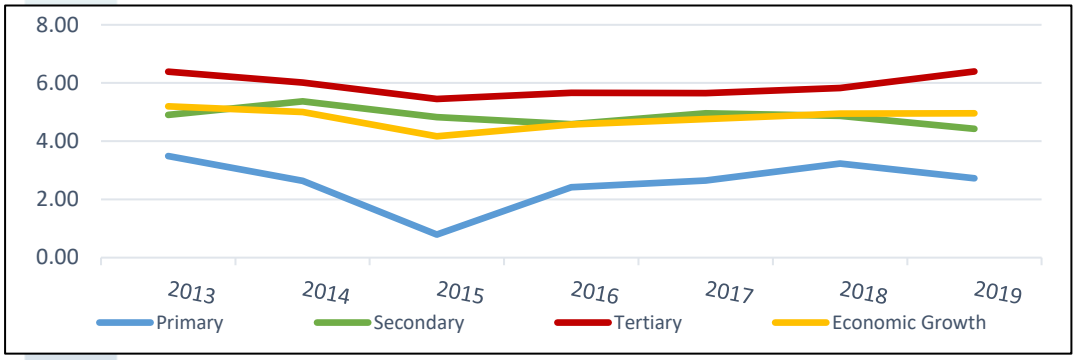
Secondary impacts due to disasters can be in the form of inhibition of economic growth, disruption of development plans, and increasing poverty rates (Benson & Clay, 2003), regardless of the type of disaster will mostly have an impact on increasing poverty (Rush, 2013), other research was also conducted by (Silbert et al., 2012), (Baez & Santos, 2008) also concluded that disasters always increase the number of poor people. And the consequences of disasters can reduce the positive response of the labor supply (Strulik & Trimborn, 2019) due to disasters can increase the possibility of injury or disability that prevents a person from working and results in an increase in unemployment (Caruso, 2017) in his research (Supriyatna, 2007) states that the impact of disasters in addition to suppressing GDP will also increase the unemployment rate which has an impact on people's welfare, namely a decrease in household income. Production activities that are stopped will cause unemployment, so those who are unemployed cannot earn income to meet their daily needs. Research from (Rodriguez-Oreggia et al., 2013) also shows the detrimental impact of natural disasters on human development and poverty.

In addition to the direct impact of natural disasters on economic growth, poverty, and unemployment. Economic growth that is hampered due to the impact of disasters will affect the poverty rate because economic growth is one indicator to see the success of development and is also a condition for poverty reduction (Tambunan, 2001), and according to (Siregar, 2006) also states that for poverty reduction, economic growth is a necessary condition, in line with all of that (Mankiw, 2006); (Kuncoro, 2004); (Lee & Sissons, 2016) stated that economic growth will affect the level of poverty, due to poverty that occurs due to stunted growth can reduce the quality of the Human Development Index (HDI) because the development process that prioritizes community participation is closely determined by poverty (Suradi, 2007) the high poverty rate results in low purchasing power which allows the education received and the quality of health to be not optimal because in general most of the poor are not interested in engaging in activities that are not directly related to the fulfillment of basic needs, and choose to spend their available energy and time to fulfill basic needs (Mirza, 2012)

The impact that is also caused due to the lack of maximum economic growth has an impact on the unemployment rate, as stated by Okun's Law, causing growth affect the unemployment rate (Misini & Badivuku-Pantina, 2017), in line with that, the consequences arising from not decreasing the unemployment rate can reduce the index Human Development (IPM) this occurs because of the impact of unemployment that occurs (Hamzah et al., 2012); (Baeti, 2013).

Although natural disasters are considered negative, several other studies have shown a positive correlation between natural disasters and economic growth such as research by (Albala-Bertrand, 1993); (Skidmore & Toya, 2002); (Muzakar Isa, 2016) as well as at the level of areas not affected by natural disasters the overall impact, such as the phenomena experienced by the provinces of West Sumatra and Yogyakarta, these two provinces in Indonesia recorded high positive growth in the year the disaster occurred (Nazamuddin & Nugroho, 2019). For Indonesia, economic growth in the period 2013 to 2019 fluctuated, but the diverse growth patterns were reflected in economic growth if grouped into primary, secondary, and tertiary sectors.

Figure 3. Growth of Primary, Secondary, and Tertiary Economic Growth in Indonesia



Source: Badan Pusat Indonesia (2020)

Indonesia's economic growth fluctuated from 2013 to 2019 at the beginning of the 2015 period, economic growth decreased and reached its lowest point in the study period, but in the same year, natural disasters that occurred in Indonesia were also at their lowest in terms of intensity and the following year. Experienced an increase in terms of growth until 2018 and decreased in 2019, but during the same period, the intensity of disasters that occurred continued to increase.

However, Indonesia's economic growth rate based on the primary, secondary, and tertiary sectors experienced mixed growth compared to the overall economic growth pattern. Furthermore, (Okuyama, 2003), and (Okuyama et al., 2004) states that older facilities or equipment are more susceptible to damage when a disaster hits the capital stock, so replacing them would result in a positive productivity shock, which may have a sizeable impact on growth rates after the disaster.

In terms of human resources, data collected from BPS shows that while the intensity of natural disasters that hit the territory of Indonesia tends to increase every year, the level of poverty and disturbance in Indonesia has a downward trend in the period 2013 to 2019, this is possible where according to research (Ewing et al., 2009) stated that post-disaster reconstruction can increase the rate of labor absorption which will accelerate the accumulation of human capital (Sufiyan, 2014) in his research stated that the unemployment rate decreased, and non-agricultural private employment increased when disaster losses increased. Loss of property created a lot of work during the recovery and reconstruction period. The unemployment rate has decreased and per capita income has increased as disaster losses have increased in the affected areas. Correspondingly, the reduction in poverty and unemployment can trigger an increase in the human development index (Mirza, 2012); (Baeti, 2013).

Based on the descriptions above, there is a direct relationship between natural disasters and economic growth, natural disasters and poverty, natural disasters and unemployment. But also from the description that indirectly explained the level of economic growth affected by the disaster could affect poverty, as well as unemployment, the impact received by human capital also indirectly resulted in the quality of human development facing the resulting consequences, and added With the varied conditions of economic, socio-economic, and geographical characteristics in Indonesia, it triggers researchers to be able to know and analyze the relationship between variables, both directly and indirectly.

2. LITERATURE REVIEW

Disasters can create significant and intense damage to the capital stock, as well as to labor, for example, more than 230,000 victims in the 2004 Indian Ocean earthquake and

tsunami. Although natural disasters are not frequently repeated, the damage from disasters varies widely from one to another, and from one area to another. Natural disasters also have a direct impact on poverty and can hinder development.

Furthermore, by using the simple growth theory framework of the Solow model (Solow, 1956) used by (Okuyama, 2003) also used in this study with a note that technological progress is ignored, the economic production function can be defined as (C. K. Kim, 2010):

$$Y = F(K, L) \quad (1)$$

Where Y denotes total output, K is the level of capital accumulation, and L is the amount of labor input. With the property of constant returns to scale, the production function can be converted into the per capita form:

$$y = f(k) \quad (2)$$

Where y is output per capita and k is capital stock per capita. Let s denote the saving rate, δ the depreciation rate, and n, the population growth rate. Then the level of capital stock k^* (*steady-state*) satisfies the following conditions:

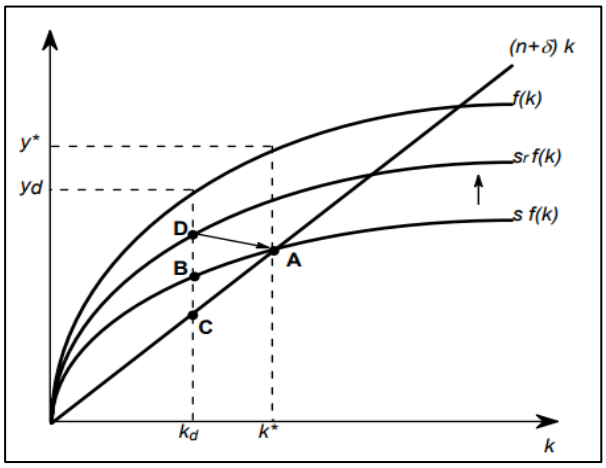
$$\Delta k = s.f(k) - (n + \delta) \cdot k = 0 \quad (3)$$

Set terms,

$$s.f(k^*) - (n + \delta) \cdot k^* \quad (4)$$

This steady state situation is described in point A of Figure 4 (C.K. Kim, 2010) Now suppose a disaster that occurs destroys the physical capital but the human population is not injured. The total capital stock per capita decreases from k^* to k_d, and the economy's per capita output decreases from the steady state level y^* to y_d.

Figure 4. Solow-Swan Model and Disaster Situation



Source: (Okuyama, 2003)

After a disaster, it is assumed that the economy will go through a recovery period. In the recovery period, resources are allocated for the reconstruction of the damaged capital stock. In addition, there may also be international assistance that can stimulate the

accumulation of physical capital. The economy, therefore, experiences brief periods of higher s_r savings, which accelerates the pace of recovery. As the economy recovers from the breakdown, the saving rate returns to its original saving rate s. The economy returns to the steady state per capita capital stock, k^*, (movement from D to A), and the steady state per capita output level, y^* (C. K. Kim, 2010).

All types of disasters can disrupt investment plans for both physical capital and human resources. Benson and Clay 2004 (Asyari, 2012) state that damage to stock values or economic assets such as business premises, buildings, and houses that occur as a result of natural disasters will all cause losses. Which as a result can stop or disrupt production activities resulting in a decrease in output, besides that (Fankhauser et al., 1997) and (Fankhauser & Tol, 2005) show that disasters will require more frequent adjustments in the capital stock, especially those related to expenditure defensive. The fast or slow recovery from a disaster depends on the amount of capital stock allocated for reconstruction activities (Okuyama, 2003).

Besides that, the quality of human resources can be reduced after natural disasters due to loss of skills in the workforce through increased rates of disability (Caruso, 2017) and the number of fatalities due to disasters. Also, migration after a disaster can bring about a further reduction in the human resource stock and future accumulation, especially of skilled workers who choose to relocate. However, on the other hand, natural disasters can actually have a positive impact, (Okuyama, 2003), and (Okuyama et al., 2004) stated that older facilities or equipment are more susceptible to damage when a disaster hits capital stock, so replacement of facilities this would result in a positive productivity shock, which may have a sizeable impact on growth rates after a disaster.

Natural disasters can damage physical capital and also affect human capital. Disaster risk of an area is defined as the possibility that a natural disaster will damage or destroy physical capital (Skidmore & Toya, 2002). In some cases, natural disasters can destroy the lives of community members. They lost all or part of what they owned, such as family members, pets, and crops, as well as houses, fields, and paddy fields on which their livelihood depended (Mwape, 2009).

Furthermore (Rush, 2013) conducted research which stated that the majority of types of disasters will have an impact that increases the poverty rate. Rush's research is supported by findings (Hallegatte et al., 2010), that when a disaster occurs the poverty rate tends to increase. Furthermore (Silbert et al., 2012); (Baez & Santos, 2008) also stated that disasters always have an impact on increasing the number of poor people and have an impact on poverty levels in urban areas (Rodriguez-Oreggia et al., 2013) and rural areas (Arouri et al., 2015). And whatever form the disaster occurs will increase the poverty rate (Rush, 2013), (Hasan & Zaidi, 2012). Furthermore, the movement of the poverty rate is also an effect of increasing or decreasing economic growth rates, as stated by (Sukirno, 2014), (Ocaya et al., 2012), (Fosu, 2011).

(Caruso, 2017) found that disasters increase the likelihood of causing disability so that it is possible to prohibit or prevent someone from working and increase unemployment, and open unemployment can also increase, when natural disasters occur many companies or production factors are affected resulting in unavailable jobs, in line Therefore (Strulik & Trimborn, 2019) states that the consequences of disasters can reduce the positive response from labor supply which has an impact on the local labor market of the affected area (Coffman & Noy, 2012).

(Supriyatna, 2007) In his research, it was stated that the consequences of the disaster, apart from depressing GDP, would also increase the unemployment rate which would impact on people's welfare (a decrease in household income). If this happens over a long period of time, it will increase the poverty rate and new unemployment which will also

systematically affect the Human Development Index (HDI) (Bowo, 2014), (Mirza, 2012), (Baeti, 2013) stated HDI can be influenced by economic growth, the percentage of poverty, and the percentage of unemployment. HDI indicators consist of education, health, and purchasing power (expenditure) (BPS, Human Development Index, 2014). Households can fall into poverty traps, as a result of which poor people often make choices such as selling assets, removing children from school, and reducing health care and consumption as an effort to reduce risk or also limit so as not to fall into prolonged poverty (Krishna, 2007). Which also in other words will reduce the human development index and will be able to increase the poverty rate (Mnitp & Mintp, 2014), and in his research (Rodriguez-Oreggia, et al, 2013) also shows the significant and detrimental effects of natural disasters on development people and poverty.

3. RESEARCH METHODS

In this research, the data used is panel data, namely 30 provinces in Indonesia namely 30 provinces in Indonesia, including Aceh, North Sumatra, West Sumatra, Riau, Jambi, South Sumatra, Bengkulu, Lampung, Bangka Belitung Islands, Riau Islands, West Java, Central Java, DI Yogyakarta, East Java, Banten, Bali, West Nusa Tenggara, East Nusa Tenggara, West Kalimantan, Central Kalimantan, South Kalimantan, East Kalimantan, North Sulawesi, Central Sulawesi, South Sulawesi, Southeast Sulawesi, Gorontalo, West Sulawesi, Maluku, and North Maluku. From 2013 to 2019.

This study uses secondary data obtained from various sources, namely Badan Nasional Penanggulangan Bencana (BNPB) Republic of Indonesia, and Badan Pusat Statistik (BPS) Indonesia. The research variables used are independent variable (X), intermediate variable (Z), and dependent variable (Y), and there are several latent variables. The data used in this study are:

a. Natural Disasters (X1) consist of the dimensions of whirlwinds, floods, and landslides with each indicator, namely the number of fatalities, the number of injured victims, the number of houses affected, and the number of public facilities affected by the whirlwinds, floods, and landslides in 30 provinces in Indonesia,
b. Regional Economic Growth (Z1) the regional economic growth variable is obtained from the growth of Gross Regional Domestic Income (GRDP) based on constant prices from 30 provinces in Indonesia which are divided into 3 sector categories, namely the primary sector, secondary sector, and tertiary sector,
c. Poverty (Z2) the poverty variable is divided into two categories, namely the number of poor people in urban and rural Indonesia which is collected on the second count (September) from 30 provinces in Indonesia,
d. Unemployment (Z3) the unemployment variable is the population aged 15 years and over, registered as unemployed, both those who have worked and those who have never worked before from 30 provinces in Indonesia,
e. Human Development Index (HDI) (Y) the human development index variable which is the geometric average of three-dimensional indices, namely the health index, education index, and expenditure index from 30 provinces in Indonesia

The data analysis method uses Partial Least Square, using formative constructs, there are three calculation stages in PLS, namely (Sarwono & Narimawati, 2015); (Husain, 2015):

a. Measurement model (outer model): reliability indicator using outer weight and outer loadings, and Collinearity indicator using Variance Inflated Factor (VIF);
b. Structural model (inner model): R-square (R^2), Q-square predictive relevance (Q^2), q-square effect size (q^2), f-square effect size (f^2), and goodness of fit (GoF);
c. Hypothesis Testing: direct influence, and indirect influence.

4. FINDINGS

4.1 Result

The path diagram of the model structure built in this study consists of one exogenous variable, namely natural disasters ($\xi 1$) and four endogenous variables including regional economic growth ($\eta 1$), poverty ($\eta 2$), unemployment ($\eta 3$), and the human development index ($\eta 4$).

It is suspected that regional economic growth ($\eta 1$) is influenced by natural disasters ($\xi 1$), poverty ($\eta 2$) is influenced by natural disasters ($\xi 1$) and regional economic growth ($\eta 1$), unemployment ($\eta 3$) is influenced by natural disasters ($\xi 1$) and regional economic growth ($\eta 1$), and the human development index ($\eta 4$), influenced by regional economic growth ($\eta 1$), poverty ($\eta 2$), and unemployment ($\eta 3$).

- Natural disaster latent variable ($\xi 1$) is influenced by three formative dimensions, namely:
  a. The dimensions of the whirlwinds ($\xi 2$) are determined by four formative indicators: the number of fatalities (X1.1), the number of injured (X1.2), the number of houses affected (X1.3), and the number of facilities affected public (X1.4) by whirlwinds;
  b. The dimensions of the floods ($\xi 3$) are determined by four formative indicators: the number of fatalities (X2.1), the number of injured (X2.2), the number of houses affected (X2.3), and the number of public facilities affected impact (X2.4) by floods;
  c. The dimensions of the landslides ($\xi 4$) are determined by four formative indicators: the number of fatalities (X3.1), the number of fatalities (X3.2), the number of houses (X3.3), and the number of building public facilities (X3.4) by landslides.

- The regional economic growth latent variable ($\eta 1$) is influenced by three formative indicators, namely:
  a. Primary sector (Y1), 2) Secondary sector (Y2), 3)Tertiary sector (Y3);

- The poverty latent variable ($\eta 2$) is influenced by two formative indicators:
  a. The number of poor people in urban areas (Y4),
  b. The number of poor people in rural areas (Y5);

- The unemployment latent variable ($\eta 3$) is influenced by one formative indicator: unemployment (Y6);

- Human development index variable ($\eta 4$) is influenced by one formative indicator: human development index (Y7)

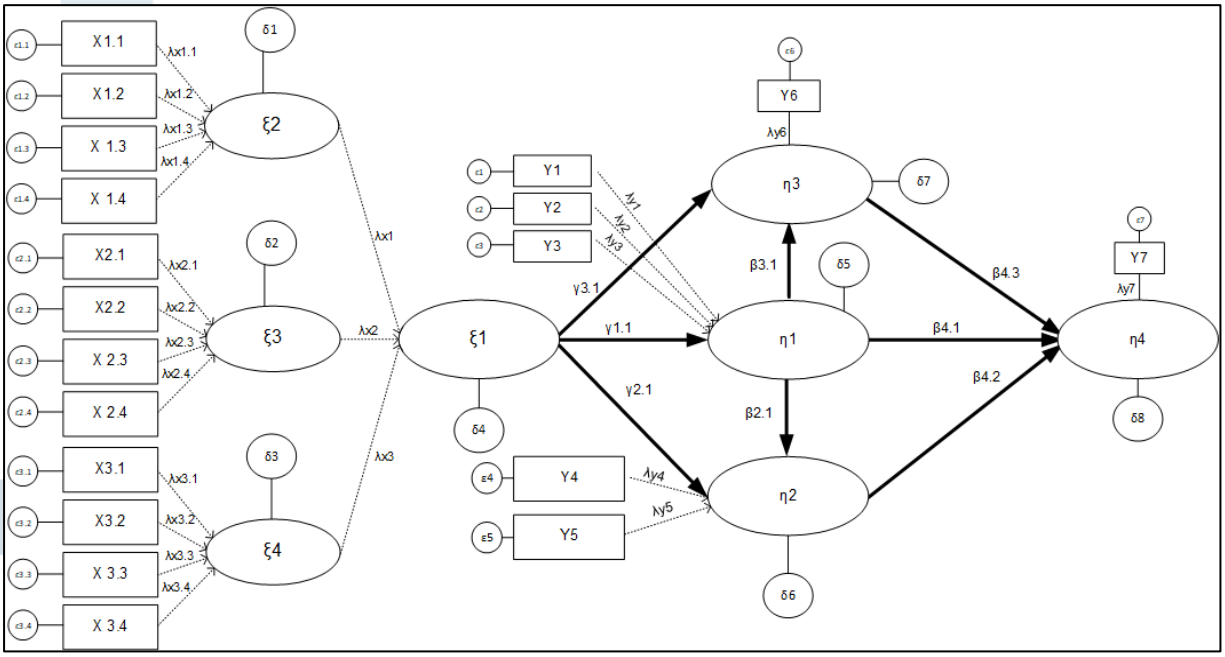
Mathematically translated into the following equation:

$$\eta 1 = f(\xi 1); \qquad \eta 3 = f(\xi 1, \eta 1);$$

$$\eta 2 = f(\xi 1, \eta 1); \qquad \eta 4 = f(\eta 1, \eta 2, \eta 3).$$

These variables can be described in the form of a path diagram according to the following figure:

Figure 5. Path Diagram



Source: Badan Pusat Indonesia (2020)

Based on the path diagram in Figure 5, the next step is to convert it into a mathematical equation model of the measurement model (outer model) and structural model (inner model).

a. Measurement Model (Outer model)

1) Natural disaster variable (Second Order):

Whirlwinds dimensions: $\xi 2 = \lambda x1.1x1.1 + \lambda x1.2x1.2 + \lambda x1.3x1.3 + \lambda x1.4x1.4 + \delta 1$

Floods dimensions: $\xi 3 = \lambda x2.1x2.1 + \lambda x2.2x2.2 + \lambda x2.3x2.3 + \lambda x2.4x2.4 + \delta 2$

Landslides dimensions: $\xi 4 = \lambda x3.1x3.1 + \lambda x3.2x3.2 + \lambda x3.3x3 + \lambda x3.4x3.4 + \delta 3$

Natural disaster latent variables: $\xi 1 = f\ (\xi 2, \xi 3, \xi 4)$,

2) Regional economic growth variables: $\eta 1 = \lambda y1y1 + \lambda y2y2 + \lambda y3y3 + \varepsilon 5$

3) Poverty variables: $\eta 2 = \lambda y4y4 + \lambda y5y5 + \varepsilon 6$

4) Unemployment variables: $\eta 3 = \lambda y6y6 + \varepsilon 7$

5) Human development index variables: $\eta 4 = \lambda y7y7 + \varepsilon 8$

b. Structural Model (Inner Model)

1. Structural Model 1: $\eta 1 = f\ (\xi 1)$;
2. Structural Model 2: $\eta 2 = f\ (\xi 1, \eta 1)$;
3. Structural Model 3: $\eta 3 = f\ (\xi 1, \eta 1)$;
4. Structural Model 4: $\eta 4 = f\ (\eta 1, \eta 2, \eta 3)$.

4.2 Evaluation of the Measurement Model (Outer Model) with Formative Indicators

4.2.1 Reliability Indicator

Table 1. Outer Weight, and Outer Loadings

Path	T Statistics	Outer Loadings
The Number of Fatalities ➞ Whirlwinds	0.533	0.197
The Number of Injured Victims ➞ Whirlwinds	0.553	**0.637
The Number of Houses Affected ➞ Whirlwinds	*1.903	**0.941
The Number of Public Facilities ➞ Whirlwinds	0.504	**0.648
The Number of Fatalities ➞ Floods	1.873	-0.218
The Number of Injured Victims ➞ Floods	1.111	-0.336
The Number of Houses Affected ➞ Floods	*2.977	**0.694
The Number of Public Facilities ➞ Floods	0.374	0.317
The Number of Fatalities ➞ Landslides	0.254	**0.682
The Number of Injured Victims ➞ Landslides	1.498	**0.993
The Number of Houses Affected ➞ Landslides	0.053	**0.682
The Number of Public Facilities ➞ Landslides	0.213	**0.565
The Number of Fatalities (by whirlwinds) ➞ Natural Disaster	0.683	0.048
The Number of Injured Victims (by whirlwinds) ➞ Natural Disaster	0.685	0.156
The Number of Houses Affected (by whirlwinds) ➞ Natural Disaster	1.433	0.23
Path	**T Statistics**	**Outer Loadings**
The Number of Public Facilities (by whirlwinds)➞ Natural Disaster	0.322	0.158
The Number of Fatalities (by floods)➞ Natural Disaster	*2.019	-0.213
The Number of Injured Victims (by floods) ➞ Natural Disaster	1.154	-0.328
The Number of Houses Affected (by floods) ➞ Natural Disaster	*3.082	**0.678
The Number of Public Facilities (by floods) ➞ Natural Disaster	0.399	0.31
The Number of Fatalities (by landslides) ➞ Natural Disaster	0.006	0.272
The Number of Injured Victims (by landslides) ➞ Natural Disaster	0.179	0.396
The Number of Houses Affected (by landslides) ➞ Natural Disaster	0.139	0.272
The Number of Public Facilities (by landslides) ➞ Natural Disaster	0.302	0.225
Primary Sector ➞ Regional Economic Growth	1.774	**0.544
Secondary Sector ➞ Regional Economic Growth	1.562	**0.552
Tertiary Sector ➞ Regional Economic Growth	*4.196	**0.891
The Number Of Poor People In Rural ➞ Poverty	*7.102	**0.995
The Number Of Poor People In Urban ➞ Poverty	0.496	**0.521

*Outer Weight > 1.96
** Outer Loadings > 0.5
Source: (Research Data Processed, 2021)

By knowing the validity of the outer weight seen based on the T-statistical value > T-table (α=5%), it can be seen that there are still many indicators whose T-statistical value is below 1.96 or it can be said to be invalid for measuring the latent variable. (Hair et al., 2014) suggested that if the outer weight of an indicator is not significant but the outer loadings are above 0.5, the indicator can be maintained in the model.

Furthermore, by looking at the value of the outer loading, it turns out that there are still many indicators that produce outer loading below 0.5 or it can be said to be invalid on the model.

Based on the evaluation of the formative measurement model, it was concluded that there were indicators that did not meet the outer loadings value significance criteria for the formative indicator model. Therefore, invalid indicators were not included in further analysis. After the indicators are removed from the model, the next step is to re-evaluate the formed model.

Convergent validity testing for each formative indicator on latent variables after eliminating indicators that do not meet convergent validity are as follows:

Table 2. Outer Loadings after Non-Significant Indicators are issued

Path	Outer Loadings	VIF
The Number of Injured Victims ➞ Whirlwinds	*0.829	**3.452
The Number of Houses Affected ➞ Whirlwinds	*0.974	**4.446
The Number of Public Facilities ➞ Whirlwinds	*0.68	**3.275
The Number of Houses Affected ➞ Floods	*1	**1
The Number of Fatalities ➞ Landslides	*0.818	**2.531
The Number of Injured Victims ➞ Landslides	*0.98	**3.113
The Number of Houses Affected ➞ Landslides	*0.823	**2.532
The Number of Public Facilities ➞ Landslides	*0.655	**1.89
The Number of Houses Affected (by floods) ➞ Natural Disaster	*1	**1
Primary Sector ➞ Regional Economic Growth	*0.593	**1.083
Secondary Sector ➞ Regional Economic Growth	*0.609	**1.11
Tertiary Sector ➞ Regional Economic Growth	*0.842	**1.101
The Number Of Poor People In Rural ➞ Poverty	*0.995	**1.227
The Number Of Poor People In Urban ➞ Poverty	*0.517	**1.227
Unemployment➞ Unemployment	*1	**1
HDI➞HDI	*1	**1

*Outer Loadings > 0.5
** VIF < 5
Source: (Research Data Processed, 2021)

From these results, it can be concluded that the estimated value of outer loadings on all indicators is significant with the value of outer loadings > 0.5. Therefore, it can be concluded that all these formative indicators have a valid effect on each of the latent variables.

4.2.2 Collinearity Indicator

The test results show that there is no multicollinearity in the formative indicators in each latent variable. This is indicated by the outer VIF value which is less than 5 for all of these indicators.

4.3 Evaluation of the Structural Model (Inner Model)

4.3.1 Coefficient of Determination Value (R^2)

The value of R^2 for the latent variable of regional economic growth is 0.048 which means that the variation of the regional economic growth variable can be explained by 0.48 percent by the natural disaster variable. Meanwhile, the other 99.62 percent were influenced by other variables that were not hypothesized in the research model. The value of R^2 for the latent variable of poverty is 0.001 which means that the variation of the latent variable of poverty that can be explained by the variables of natural disasters and economic growth is 0.01 percent. Meanwhile, the rest is influenced by other variables outside the model. The value of R^2 for the latent variable of unemployment is 0.124, which means that the variation of the unemployment variable that can be explained by the natural disaster variable and regional economic growth is 12.4 percent. While the other 87.6 percent, influenced by other variables that are not hypothesized in this research model, and the R^2 value for the human development index variable is 0.184 which means that the variation of the unemployment variable that can be explained by the regional economic growth variables, poverty, and unemployment is 18.4 percent. While the other 82.6 percent are influenced by other variables that are not hypothesized in this research model

4.3.2 Predictive Relevance (Q-Square Predictive Relevance)

Analysis of Q-square (Q^2) and q^2 effect size. Q-square can be seen in the results of the blindfolding calculation in the cross-validated redundancy construct section. The results of these calculations can be seen in Table 3 below.

Table 3. Q-Square Predictive Relevance

Variable	SSO	SSE	Q² (=1-SSE/SSO)
Natural Disaster	210	11.074	0.947
Regional Economic Growth	630	618.95	0.018
Poverty	420	420.518	-0.001
Unemployment	210	184.655	0.121
HDI	210	172.934	0.177

Source: (Research Data Processed, 2021)

From the calculation results in Table 3. In the poverty variable, the value of Q^2 is found to be less than zero, the model lacks predictive relevance, while the rest produces a Q^2 value of more than zero, so the rest of the poverty variable has met the predictive relevance where the model has been reconstructed properly.

After knowing the value of Q^2, then the value of the q-square effect size can be calculated. The calculation formula for q^2 is Q^2 included minus Q^2 excluded compared to 1 – Q^2 included. Q^2 predictive relevance included is the value of Q^2 where all variables are entered into the model. The value of Q^2 predictive relevance included can be seen from the Q^2 dependent variable. Q^2 predictive relevance excluded is the value of Q^2can be found when the variable for which the effect size is to be determined is omitted from the model.

Table 4. The Calculation Results q^2

Dependent Variable	Q^2Include	Independent Variable	Q^2Exclude	q^2	Result
Regional Economic Growth	0.018	Natural Disaster	0.947	-0.94603	Large Negative
Poverty	-0.001	Natural Disaster	0.947	-0.94705	Large Negative
		Regional Economic Growth	0.018	-0.01898	Weak Negative
Unemployment	0.121	Natural Disaster	0.947	-0.9397	Large Negative
		Regional Economic Growth	0.016	0.119454	Weak
HDI	0.177	Regional Economic Growth	0.016	0.195626	Moderate
		Poverty	-0.008	0.224787	Moderate
		Unemployment	0.129	0.058323	Weak

Source: (Research Data Processed, 2021)

The categorization of q^2 values is 0.02 (weak), 0.15 (medium/moderate), and 0.35 (large) (Wijaya, 2019); (Sarwono & Narimawati, 2015). From Table 4 above, it is known that the impact of structural model 1 on regional economic growth variables, the measurement of predictor variables shows a strong but negative change in influence when the natural disaster variable is removed from the model.

In structural model 2 of the poverty variable, the measurement of the predictor variable shows a strong but negative change in influence when the natural disaster variable is removed from the model, the measurement of the predictor variable shows a weak and negative effect when the regional economic growth variable is removed from the model.

In structural model 3 of the unemployment variable, the measurement of the predictor variable shows a strong but negative change in influence when the natural disaster variable is removed from the model, the measurement of the predictor variable shows a weak change in influence when the economic growth variable is removed from the model.

Structural 4 on the human development index variable, the measurement of the predictor variable shows a moderate change in influence when the regional economic growth variable is removed from the model, the measurement of the predictor variable shows a moderate change in influence when the poverty variable is excluded from the model, and the measurement of the predictor variable shows a weak change in influence when the poverty variable was excluded from the model.

4.3.3 Analysis of f-Square Effect Size (f^2)

The f-square value is used to determine the effect of the predictor variable on the dependent variable. The value of f^2 can be known from the formula (Sarwono & Narimawati, 2015):

$$f^2 = \frac{(R^2\ included\ -\ R^2\ excluded)}{(1 - R^2\ included)}$$

The value of R^2 included is the value of R^2 of the dependent variable when all variables are entered into the model. The value or score of R^2 included is then compared with the value of R^2 excluded to find the value of f-square effect size (f^2). The value of R^2 excluded is the value of R^2 of the variable whose effect size is to be known and excluded from the model. The values of R^2 included and R^2 are excluded and the results of the calculation of f^2 are presented in the following Table 5:

Table 5. The Calculation Results f^2

Dependent Variable	R^2 Include	Independent Variable	R^2 Exclude	f^2	Result
Regional Economic Growth	0.043	Natural Disaster	1	-1	Strong Negative
Poverty	-0.009	Natural Disaster	1	-1	Strong Negative
		Regional Economic Growth	0.048	-0.05649	Weak Negative
Unemployment	0.115	Natural Disaster	1	-1	Strong Negative
		Regional Economic Growth	0.045	0.079096	Weak
HDI	0.172	Regional Economic Growth	0.045	0.153382	Moderate
		Poverty	0.005	0.201691	Moderate
		Unemployment	0.132	0.048309	Weak

Source: (Research Data Processed, 2021)

Just like the division of categories in q^2, the f^2 category is also divided into three, namely 0.02 is a weak influence, 0.15 is a moderate influence, and 0.35 is a strong influence) (Wijaya, 2019); (Sarwono & Narimawati, 2015). From Table 5 above it is known that all structural 1, structural 2, structural 3, and structural 4 have a change in effect that is identical to the change in influence on q^2 effect size

4.4 Goodness of Fit (GoF) Analysis

The overall goodness of the model can be tested by calculating the Goodness of Fit (GoF) value. GoF is a measure used to validate the combined performance of the measurement model and the structural model. The calculation of the GoF value is formulated as follows:

GoF : $\sqrt{\overline{com}\ X\ \overline{R^2}}$…….(Husain, 2015)

$\overline{com}$: The average value of communality; $\overline{R^2}$: The average of R^2.

The GoF values for this research model are:

GoF : $\sqrt{\overline{com}\ X\ \overline{R^2}}$ GoF : $\sqrt{0{,}271\ X\ 0{,}647}$ = 0,419

The greater the GoF value, the more appropriate the description of the model.

The GoF value categories according to (Sarwono & Narimawati, 2015) and (Husain, 2015) are divided into three, namely 0.1 (weak), 0.25 (moderate), and 0.36 (large). The GoF value of 0.419 is interpreted as a large GoF, meaning that the measurement model (outer model) with the structural model (inner model) is feasible or valid.

4.5 Discussion

From the results of the bootstrapping calculation, the T-statistic value of each relationship or path will be obtained. The test of this hypothesis is set with a significance level of 0.05 and is two-tailed. The hypothesis can be accepted if the T-statistic value is greater than 1.96 (Jogiyanto, 2011). The results of the calculation of the direct influence hypothesis testing in this study will be explained in Table 6, and the indirect effect will be explained in Table 7:

Table 6. Direct Effect Hypothesis Testing Results

Path	Original Sample	T-Statistics	P-Values
Natural Disaster ➞ Regional Economic Growth	-0.219	*2.847	**0.005
Natural Disaster ➞ Poverty	0.015	0.273	0.785
Natural Disaster ➞ Unemployment	0.232	*3.877	**0

*T-Statistic > 1.96;**P-Value < 0.5

Source: (Research Data Processed, 2021)

4.5.1 Direct Effects of Natural Disasters on Regional Economic Growth

Referring to the estimation results, it is found that natural disasters directly have a significant negative effect on regional economic growth. This negative effect is following research (Klomp & Valckx, 2014) where climate disasters in developing countries have a significant adverse impact on economic growth. Natural disasters that hit an area can also disrupt the peace and life of a community and can also damage economic objects, buildings, houses, or infrastructure, as well as disrupt the production process. In some cases, natural disasters can destroy the lives of community members. They lose all or part of what they own, such as family members, pets, and crops, as well as houses, fields, and rice fields on which their livelihoods depend (Mwape, 2009). All of that will have an impact on the low income of the community which in turn will have an impact on decreasing economic growth at the regional and national levels. As well as the loss of breadwinners, through death or injury, disruption of production or access to markets, and the destruction of productive assets, such as home-based workshops, are examples of how disasters affect local economies and households (UNDP, 2004)

4.5.2 The Direct Effects of Natural Disasters on Poverty

Referring to the estimation results, it was found that natural disasters directly have a positive but not significant effect on regional economic growth, this positive influence is following research (Benson and clay 2004) where disasters can increase poverty rates, and whatever type of disaster will mostly have an impact on increasing poverty (Rush, 2013); and (Hallegatte et al., 2010) reinforce by stating that poverty rates tend to increase when a disaster occurs, Research conducted by (Silbert et al., 2012); (Baez & Santos, 2008) concluded also, disasters will always have the effect of increasing the number of poor people. Because the consequences of a disaster can destroy part or all of

economic objects, buildings, houses, or infrastructure, as well as disruption of the production process due to the impact of income sources such as places of business, agricultural land or plantations, and so on, and the impact of disasters can also happen to anyone such as the head of the family or the breadwinner of the family can be affected by disasters, which from there can lead to an increase in poverty as a result of natural disasters.

4.5.3 The Direct Effect of Natural Disasters on Unemployment

Referring to the estimation results, it was found that natural disasters directly have a positive and significant effect on unemployment in Indonesia, this positive influence is following research in research (Supriyatna, 2007) which states that due to disasters, the unemployment rate will increase which has an impact on people's welfare decrease in household income. Production activities are stopped causing unemployment, as a result, those who are unemployed cannot generate income for their daily needs. If in the long term this continues to happen, it will increase the new unemployment rate. (Caruso, 2017) found that disasters increase the likelihood of causing disability, thereby making it possible to prohibit or prevent a person from working and increase unemployment.

Table 7. Indirect Effect Hypothesis Testing Results

Path	Original Sample	T-Statistics	P-Values
Natural Disaster ➞ Regional Economic Growth ➞ Poverty	-0.006	0.345	0.73
Natural Disaster ➞ Regional Economic Growth ➞ Unemployment	0.048	*2.109	**0.035
Natural Disaster ➞ Regional Economic Growth ➞ HDI	0.052	*2.292	**0.022
Natural Disaster ➞ Poverty ➞ HDI	-0.006	0.269	0.788
Natural Disaster ➞ Unemployment ➞ HDI	-0.014	0.86	0.39

*T-Statistic > 1.96; **P-Value < 0.5

Source: (Research Data Processed, 2021)

4.5.4 Indirect Effects of Natural Disasters on Poverty through Regional Economic Growth

Referring to the estimation results, it is found that indirectly natural disasters mediated by economic growth produce a negative but not significant effect on poverty in Indonesia, from the direct effect of natural disasters on economic growth which produces a negative effect, where disasters will be able to reduce economic growth according to research (Klomp & Valckx, 2014), (De Oliveira, 2019). The decline in economic growth that occurs is represented by economic growth in the tertiary sector or services which are more dominant in urban areas which are known to be the indicators with the highest loadings factor, while in poverty research it is represented by rural poverty so that from there there is no decreasing effect in rural areas which is dominated by the primary sector because the sector most affected is the tertiary sector.

4.5.5 Indirect Effects of Natural Disasters on Unemployment through Regional Economic Growth

Referring to the estimation results, it is found that indirectly natural disasters mediated by economic growth have a positive and significant impact on unemployment in Indonesia. From the direct influence of natural disasters on

economic growth which produces a negative effect, where disasters will be able to reduce economic growth according to research (Klomp & Valckx, 2014), (De Oliveira, 2019), it is known that there is a decline in economic growth due to this natural disaster will indirectly increase unemployment such as research (Chaiboonsri & Wannapan, 2018) which states that a decrease in economic growth will cause an increase in unemployment. This happens because, the achievements of a company are not maximal or because of unstable economic conditions marked by a decline in economic growth, resulting in labor efficiency, so that the costs of the company are maintained, and the absorption of labor is not maximal due to this economic downturn caused by this natural disaster indirectly also increased unemployment.

4.5.6 Indirect Effects of Natural Disasters on HDI through Regional Economic Growth

Referring to the estimation results, it is found that indirectly natural disasters mediated by economic growth have a positive and significant impact on the human development index in Indonesia. From the direct influence of natural disasters on economic growth which produces a negative effect, where disasters will be able to reduce economic growth according to research (Klomp & Valckx, 2014); (De Oliveira, 2019), it is known that there is a decline in economic growth due to this natural disaster will indirectly increase the Human Development Index. Because slowing growth will lead to a decrease in carbon emissions, which implies that an economic slowdown benefits the environment (Liu et al., 2020). Due to reduced economic activities that produce emissions or waste, the improvement of environmental quality is a trigger for improving human quality.

4.5.7 Indirect effects of natural disasters on HDI through poverty

Referring to the estimation results, it is found that indirectly natural disasters mediated by poverty have a negative but not significant effect on the human development index in Indonesia. From the direct influence of natural disasters on poverty which produces a positive effect, where disasters will be able to increase poverty according to research (Rush, 2013); (Hallegatte et al., 2010), it is known that there is an increase in poverty due to this natural disaster, indirectly will reduce the human development index in Indonesia, according to research (Mirza, 2012) where an increase in poverty will lead to a decrease in the Human Development Index. Due to the increase in poverty caused by natural disasters, it will be able to destroy part or all of the buildings or cause death or injury to humans which as a result can eliminate or reduce sources of income which will indirectly reduce their opportunities to obtain health, education, and reduce their purchasing power which is directly related to their income indirectly manifested by a decrease in the Human Development Index.

4.5.8 Indirect Effects of Natural Disasters on HDI through Unemployment

Referring to the estimation results, it was found that indirectly natural disasters mediated by unemployment produced a negative but not significant effect on the human development index in Indonesia. From the direct effect of natural disasters on unemployment which produces a positive effect, where disasters will be able to increase unemployment according to research (Caruso, 2017), it is known that an increase in unemployment due to this natural disaster

will indirectly reduce the human development index in Indonesia, according to research (Baeti, 2013) where an increase in unemployment will cause a decrease in the Human Development Index. Due to natural disasters that occur in economic objects, from there the opportunity to get a job narrows because as a result of the disaster the company will adjust their costs, and also disasters can cause someone to be injured, so from there, the opportunity to get a job narrows, those who are affected find themselves that there is no income so that they cannot fulfill their basic needs, and it will make it difficult for them to get a decent life and which indirectly lowers the Human Development Index,

5. CONCLUSION(S)

Natural disasters directly reduce regional economic growth marked by a negative relationship, and have a significant effect. Furthermore, natural disasters directly increase poverty but do not have a significant effect, natural disasters directly increase unemployment, which is characterized by a positive relationship and has a significant effect

Indirectly, natural disasters through regional economic growth reduce poverty, but have no significant effect. Then indirectly natural disasters through regional economic growth increase unemployment and have a significant effect. Furthermore, natural disasters indirectly through regional economic growth increase the human development index and have a significant effect. Furthermore, natural disasters indirectly through poverty reduce the human development index but have no significant effect. And indirectly natural disasters through unemployment reduce the human development index but have no significant effect

6. REFERENCES

Albala-Bertrand, J. M. (1993). Natural disaster situations and growth: A macroeconomic model for sudden disaster impacts. World Development, 21(9), 1417–1434. https://doi.org/10.1016/0305-750X(93)90122-P

Baeti, N. (2013). Pengaruh pengangguran, pertumbuhan ekonomi, dan pengeluaran pemerintah terhadap pembangunan manusia kabupaten/kota di Provinsi Jawa Tengah tahun 2007-2011. Economics Development Analysis Journal, 2(3).

Baez, J., & Santos, I. (2008). On shaky ground: The effects of earthquakes on household income and poverty. Unpublished Manuscript.

Benson, C., & Clay, E. (2003). Economic and Financial Impacts of Natural Disasters : an Assessment of Their Effects and Options for Mitigation : Synthesis Report. Technical Report, May, 128.

Bui, A. T., Dungey, M., Nguyen, C. V., & Pham, T. P. (2014). The impact of natural disasters on household income, expenditure, poverty and inequality: Evidence from Vietnam. Applied Economics, 46(15), 1751–1766. https://doi.org/10.1080/00036846.2014.884706

Caruso, G. D. (2017). The legacy of natural disasters: The intergenerational impact of 100 years of disasters in Latin America. Journal of Development Economics, 127(March), 209–233. https://doi.org/10.1016/j.jdeveco.2017.03.007

De Oliveira, V. H. (2019). Natural disasters and economic growth in Northeast Brazil: Evidence from municipal economies of the Ceará State. Environment and Development Economics, 24(3), 271–293. https://doi.org/10.1017/S1355770X18000517

Ewing, B. T., Kruse, J. B., & Thompson, M. A. (2009). Twister! Employment responses to the 3 May 1999 Oklahoma City tornado. Applied Economics, 41(6), 691–702.

https://doi.org/10.1080/00036840601007468
Fomby, T., Ikeda, Y., & Loayza, N. V. (2013). The growth aftermath of natural disasters. Journal of Applied Econometrics, 28(3), 412–434. https://doi.org/10.1002/jae.1273
Hair, J., Hult, G., Ringle, C., & Sarstedt, M. (2014). A Primier On Partial Least Squares Structural Equation Modeling (PLS-SEM). SAGE Publication, Inc.
Hallegatte, S., Ranger, N., Bhattacharya, S., Bachu, M., Priya, S., Dhore, K., Rafique, F., Mathur, P., Naville, N., Henriet, F., Patwardhan, A., Narayanan, K., Ghosh, S., Karmakar, S., Patnaik, U., Abhayankar, A., Pohit, S., Corfee-Morlot, J., & Herweijer, C. (2010). Flood Risks, Climate Change Impacts and Adaptation Benefits in Mumbai. OECD Environment Working Papers. https://doi.org/10.1787/5km4hv6wb434-en
Hamzah, M. Z., Risqiani, R., & Sofilda, E. (2012). Human Development Quality and its Problems in Indonesia. OIDA International Journal of Sustainable Development, 5(7), 29–36.
Husain, A. S. (2015). Penelitian bisnis dan manajemen menggunakan partial least squares (PLS) dengan smart PLS 3.0, Modul ajar jurusan manajemen fakultas ekonomi dan bisnis unversitas Brawijaya.
Jogiyanto. (2011). Partial Least Square (PLS): Alternatif Structural Equation Modeling (SEM) Dalam Penelitian Bisnis. BPFE.
Klomp, J., & Valckx, K. (2014). Natural disasters and economic growth: A meta-analysis. Global Environmental Change, 26(1), 183–195. https://doi.org/10.1016/j.gloenvcha.2014.02.006
Kuncoro, M. (2004). Teori Ekonomi Pembangunan. Masalah Dan Kebijakan. Yogyakarta. BPFE.
Lee, N., & Sissons, P. (2016). Inclusive growth? The relationship between economic growth and poverty in British cities. Environment and Planning A, 48(11), 2317–2339. https://doi.org/10.1177/0308518X16656000
Liu, S., Liu, Y., Xie, L., & Xu, J. (2020). The environmental improvement under China's 'New Normal.' China Economic Journal, 13(2), 139–151. https://doi.org/10.1080/17538963.2020.1755097
Mankiw, G. N. (2006). Pengantar Teori Ekonomi Makro (Edisi Keti). Salemba Empat.
Mirza, D. S. (2012). Pengaruh Kemiskinan, Pertumbuhan Ekonomi, Dan Belanja Modal Terhadap Indeks Pembangunan Manusia Di Jawa Tengah Tahun 2006-2009. Economics Development Analysis Journal, 1(2). https://doi.org/10.15294/edaj.v1i2.474
Misini, S., & Badivuku-Pantina, M. (2017). The effect of economic growth in relation to unemployment. Journal of Economics and Economic Education Research, 18(2), 1–9.
Muzakar Isa. (2016). Bencana Alam: Berdampak Positif Atau Negatif Terhadap Pertumbuhan Ekonomi? Program Studi Manajemen Fakultas Ekonomi Universitas Muhammadiyah Surakarta, 150.
Mwape, Y. P. (2009). An impact of floods on the socio-economic livelihoods of people: A case study of Sikaunzwe Community in Kazungula District of Zambia. A Mini Dissertation for the Award of Masters Degree in Disaster Risk Management, Disaster Risk Management Training and Education Centre for Africa (DIMTEC), Faculty of Natural and Agricultural Sciences, University of the Free State, Bloemfontein.
Nazamuddin, B. S., & Nugroho, A. (2019). Post-Disaster Recovery and A New Economic Growth Path: A Comparative Study of Three Provinces in Indonesia. IOP Conference Series: Earth and Environmental Science, 273(1).

https://doi.org/10.1088/1755-1315/273/1/012061
Okuyama, Y. (2003). Economics of natural disasters: A critical review. Research Paper, 12(January 2003), 20–22.
Okuyama, Y., Hewings, G. J. D., & Sonis, M. (2004). Measuring Economic Impacts of Disasters: Interregional Input-Output Analysis Using Sequential Interindustry Model. January, 77–101. https://doi.org/10.1007/978-3-540-24787-6_5
Prathama, R., & Manurung, M. (2008). Pengantar Ilmu Ekonomi: Mikroekonomi & Makroekonomi. Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia.
Rodriguez-Oreggia, E., de la Fuente, A., de la Torre, R., & Moreno, H. A. (2013). Natural Disasters, Human Development and Poverty at the Municipal Level in Mexico. Journal of Development Studies, 49(3), 442–455. https://doi.org/10.1080/00220388.2012.700398
Rush, J. V. (2013). The impact of natural disasters on poverty in Indonesia. Department of Economics, University of Hawaii (November), 1–42.
Sarwono, J., & Narimawati, U. (2015). Membuat Skripsi, Tesis dan Disertasi dengan Partial Least Square SEM (PLS-SEM). Andi.
Silbert, M., Del, M., & Useche, P. (2012). Repeated Natural Disasters and Poverty in Island Nations: A Decade of Evidence from Indonesia. i.
Siregar, H. (2006). Perbaikan Struktur dan Pertumbuhan Ekonomi: Mendorong Investasi dan Menciptakan Lapangan Kerja. Jurnal Ekonomi Politik Dan Keuangan. INDEF. Jakarta.
Skidmore, M., & Toya, H. (2002). Do natural disasters promote long-run growth? Economic Inquiry, 40(4), 664–687. https://doi.org/10.1093/ei/40.4.664
Strulik, H., & Trimborn, T. (2019). Natural Disasters and Macroeconomic Performance. Environmental and Resource Economics, 72(4), 1069–1098. https://doi.org/10.1007/s10640-018-0239-7
Sufiyan, A. M. (2014). Disaster and Poverty: The Differential Impacts of Disaster on the Poor in the Gulf Coast Region. 1–212.
Supriyatna, Y. (2007). Analisis Dampak Bencana terhadap Perekonomian Indonesia dengan Pendekatan SNSE. Jurnal Online, Https://Lib. Ui. Ac, Id/File.
Suradi. (2007). Pembangunan Manusia, Kemiskinan, dan Kesejahteraan Sosial (Kajian tentang Kebijakan Pembangunan Kesejahteraan Sosial di Nusa Tenggara Barat). Penelitian Dan Pengembangan Kesejahteraan Sosial, 12(03), 1–11.
Tambunan, T. T. (2001). Perekonomian Indonesia: Teori dan Temuan Empiris. Ghalia Indonesia.
Tope, P. (2019). Analysis of Income Growth and Evaluation of Economic Development in Central Sulawesi, Indonesia. Russian Journal of Agricultural and Socio-Economic Sciences, 92(8), 260–264. https://doi.org/10.18551/rjoas.2019-08.28
Wijaya, A. (2019). Metode Penelitian Menggunakan Smart PLS 03. Innosain.