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The Analysis of Natural Disaster Risk Impact on Labor Market Outcomes: Does It Lead to Middle-Class Workers Decrease?

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ABSTRACT

Indonesia, as a country that is progressing towards an upper middle-income country, is facing a high incidence of disasters. Understanding how disasters impact living standards is still relatively difficult due to the lack of relevant studies in the literature. Therefore, the study aims to analyze the likelihood of individuals who were in areas with a high risk of disaster becoming middle-class workers. In this study, the incidence of disasters is represented by the disaster risk index, which comprises three components, namely the hazard, vulnerability, and capacity components in each province and regency/city based on the definition carried out by the National Disaster Management Agency (BNPB). By using logistics methods, this study found that individuals living in areas with a high risk of disaster tend to have a lower chance of becoming middle-class workers. In overcoming the labor market challenges faced by regions with high disaster risk, careful policy steps are needed that focus on strengthening capacity and reducing the risk of high investment costs. Enhancing disaster-resistant infrastructure and community networks as well as improving access to social protection services and promoting economic recovery are priorities.

Keywords: Disaster Risk Index; Labour Market Outcome; Middle-Class Workers; Sakernas Indonesia

INTRODUCTION

Indonesia is a country with a promising economy that has been able to maintain economic growth at 5 percent over the last decade. Furthermore, with stable economic growth, Indonesia is now moving towards the status of an upper-middle-income country. Indonesia was able to break out from the lower-middle income trap that it had been in since 1985 by strengthening its human resources via more focus on education and poverty alleviation. In addition to the notable decline in poverty, there has been a noticeable increase in the middle-class or middle-income population. Based on data from the National Socio-Economic Survey (SUSENAS), The World Bank (2020) estimates that the percentage of middle-class households increased from 9% in 1993 to 20% in 2014.

Many previous studies have emphasized the importance of the role of the middle class in the country's economic growth. Research conducted by Banerjee (2007) explains that the middle-class is the driver of consumption, capital accumulation, and entrepreneurship, leading to economies of scale. Loayza et al. (2012 also found that middle-class growth has contributed to a better social, political, and economic order in the country. Furthermore, Birdsall (2010) in his research explains that a more sustainable country's growth can be driven by the growth of its middle class. A report from the World Bank (2020) states the expansion of middle-class jobs can help achieve inclusive economic growth, which includes measures to lessen social inequality by reducing poverty. Ncube et al. (2011) also explain that the expansion of the middle-class is a significant medium and long-term development indicator in Africa, since it is closely linked to a quicker pace of poverty reduction. Thus, one crucial area that needs to be researched in order to promote the expansion of the middle-class is the availability of middle-class jobs.

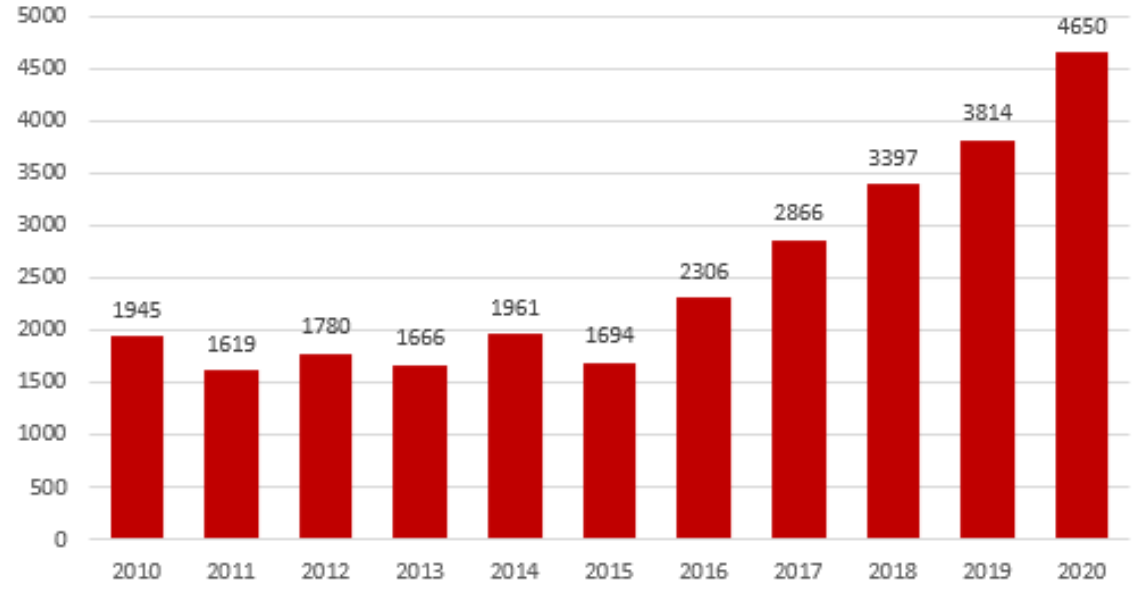
One important indicator that needs to be considered in maintaining the consistency of Indonesia's middle-class is the risk factor for natural disasters. This is inseparable from the point of view that the high risk of natural disasters can threaten economic sustainability in the area. The accumulation of physical stocks and human capital can be hindered by natural disasters, which can result in devastating long-term impacts (Yamauchi et al., 2009), which consequently has detrimental effects on future revenue streams. Disaster issues become more crucial in developing countries, considering that households in developing countries, especially those with low incomes, are very vulnerable to natural disasters. This phenomenon is brought on by household welfare levels that are almost at the poverty line, as well as the fact that these nations typically lack robust institutions for disaster relief and/or an early warning system. Therefore, examining the relationship between disaster events and a country's development indicators is quite important for the planning of upcoming developments.

Indonesia, as a country that is progressing towards an upper middle-income country, is facing a high incidence of disasters. National Disaster Management Agency (BNPB) recorded a continuous upward trend in disaster events from 2010 and reached the highest number in 2020 as many as 4977 events (Figure 1). Even BNPB noted that disaster events also caused economic or social losses with many casualties. In the last 10 years, on average there are 909 fatalities per year due to disasters. This becomes an emphasis on the importance of overcoming disaster problems in Indonesia.

Despite the increasing number of natural disasters every year, how natural disasters can affect socio-economic living standards is very complex, as there is limited literature addressing the causal relationship between these phenomena (Sawada, 2007). Moreover, there is not much literature discussing how the dynamics of the local labor

market, especially in developing countries, adapt to the devastating shocks of the disaster. In this regard, Rodriguez-Oreggia et al. (2013) emphasize that there is still very limited evidence on the impact of natural disasters on the labor market.

Figure 1. Disaster Incidents in Indonesia in the Last 10 Years



Source: BNPB (2020), processed

Several previous studies such as those conducted by Acevedo (2016), Zivin and Neidell (2014), and Kirchberger (2017) have indeed assessed the impact of disasters on the labor market. The study, however, makes use of aggregated macroeconomic data, which might not accurately reflect how households react to calamities. The economic literature exploring the impact of natural disasters at the household level or utilizing microdata remains relatively sparse (Rodriguez-Oreggia et al., 2013). Therefore, this study seeks to identify how the impact of natural disasters on labor market outcomes by utilizing microdata from the 2020 Labor Force Survey (SAKERNAS) in Indonesia. Specifically, this study wants to find out whether high disaster risk has the potential to reduce the proportion of the middle class.

LITERATURE REVIEW

This study refers to prior research investigating the impact of external shocks, such as natural disasters, on the dynamics of the labor market. In this context, middle-class occupations are considered part of the formal labor market. To comprehend the impact of natural disasters on the labor market of the middle class, this research employs the classical theory of supply and demand in a two-sector labor market, distinguishing between the formal and informal sectors (refer to Figure 2). In this framework, natural disasters are expected to affect the mobility of workers between the formal and informal sectors. With a high incidence of natural disasters, the demand for labor in the formal sector is anticipated to decline, leading to a reduction in the number of employed workers from L1 to L2 and resulting in an oversupply (Figure 2, panel a). In a nation where social security for the unemployed is relatively nonexistent, individuals who were previously excluded from the formal sector find themselves compelled to transition to the informal sector for survival (Pratomo, 2014). Illustrated in Figure 2, panel b, the augmented labor supply in the informal sector is depicted by a shift in the labor supply curve from LS1 to LS2. This upsurge in labor supply consequently leads to a rise in the workforce engaged in the informal sector, where remuneration tends to be lower (from L3 to L4).

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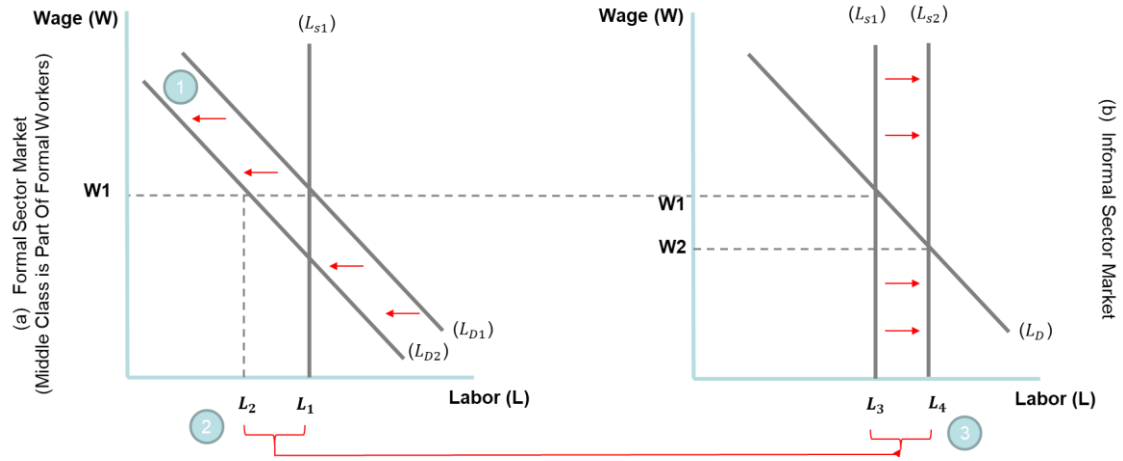
Figure 2. The Impact of Disasters on the Labor Market



Source: Adapted from Ehrenberg and Smith (2012)

However, the majority of the literatures are still in the macro scope which may not be perfectly representative at the household level. Several studies on the impact of disasters on the labor market have focused on income or unemployment (Acevedo 2016; Zivin & Neidell, 2014; Belasen & Polachek, 2008; Rodriguez-Oreggia et al., 2013; Spencer & Polachek, 2015; Mueller & Quisumbing, 2010; Putranto et al., 2022). In their studies examining the connection between natural disasters and employment, Acevedo (2016) and Zivin & Neidell (2014) discovered that events like floods were linked to a rise in unemployment, particularly affecting women to a greater extent. Another observation from their research is a decline in labor earnings followed by a decrease in the labor force participation rate.

Belasen and Polachek (2008) examined the labor market repercussions of hurricanes in Florida by leveraging variations in county-level income and employment rates, which were derived from quarterly data. Despite discovering a positive impact of the disaster on income, the study revealed a concomitant negative effect on employment levels. Mueller and Quisumbing (2010) analyzed data from the Bangladesh Flood Impact Panel Household Survey to assess the repercussions of the 1998 floods. The findings indicated immediate wage losses for agricultural workers and prolonged wage losses for non-agricultural workers. Furthermore, the study demonstrated a more pronounced decline in short-term wages for individuals farther from the market, although the distance to the market exhibited a positive correlation with long-term wages. In a related investigation, Banerjee (2007) examined the influence of floods in Bangladesh on the wages of male agricultural workers. The study identified a negative effect if flooding occurred during the dry harvest season but a positive effect if flooding occurred during the rainy season cropping season.

Jayachandran (2006) delves into the intricate dynamics between wages and weather shocks in the agricultural labor market through an indirect examination. This investigation grounded in data sourced from a comprehensive panel encompassing 257 districts across India, reveals a noteworthy phenomenon: agricultural wages exhibit heightened responsiveness to productivity shocks. This heightened sensitivity can be attributed to the prevailing absence of robust financial institutions and limited migration opportunities within the context of the agricultural sector. These factors contribute to a scenario where the supply of labor becomes less elastic, accentuating the impact of productivity fluctuations on wages.

Expanding this analytical lens to Brazil, Mueller and Osgood (2009) undertake a similar endeavor by employing a reduced-form model. The findings further underscore the interconnectedness of climatic events and wage dynamics in rural settings. Specifically, the study unravels a persistently negative wage effect stemming from drought conditions. This deleterious impact extends over an extended temporal horizon, influencing rural wages for up to five years following the occurrence of the climatic stressor. The nuanced insights derived from these studies contribute to a richer understanding of the lasting repercussions of weather-related shocks on labor markets, emphasizing the importance of considering contextual factors in such analyses. Caruso (2017) found that disasters can exert long-term effects, particularly on children and youth. These effects manifest through diminished accumulation of human capital, poorer health outcomes, and reduced asset accumulation as they transition into adulthood.

A study conducted by Garzón (2017) explains the impact of a tornado disaster on unemployment and the tendency for workers to transition to the informal sector. The findings indicate that, overall, the incidence of natural disasters does not significantly impact unemployment. However, it does correlate positively with the probability of individuals transitioning to informal employment, irrespective of their prior formal or informal work status. The probability of being an informal worker ranges between 8.5 and 14.5 percent depending on the worker's initial circumstances and the timing of the storm.

Lu et al. (2022) examine the impact of natural disasters on farmers' welfare. Specifically, the research wants to see how vulnerable farmers are to falling into poverty when hit by a disaster. The results show that natural disasters have a significant positive influence on the vulnerability of farming households to poverty. This study also conducted threshold tests to see how different the impact of natural disasters is on certain groups of farmers. The results show that the impact of natural disasters will be felt more heavily by farmers with lower buffer capacity, self-organization capacity, and learning capacity.

In another welfare outcome, Dartanto (2022) investigates how natural disasters can lead to an increase in the number of people living in poverty. By utilizing data from the Indonesian Family Life Survey (IFLS) waves 3 and 4, the results show that natural disasters, increase the possibility of individuals becoming poor groups in particular. Furthermore, the study also found that earthquakes are the type of disaster with the greatest negative impact. Similar findings were also reported by González et al. (2021), indicating that individuals impacted by natural disasters are more likely to experience poverty as they mature.

The negative impact of natural disasters can also be seen from the aspect of income inequality. Pleninger (2022) estimates the impact of natural disasters on income distribution using county-level data in the United States. The findings indicate that middle-income groups bear the brunt of the negative impacts of natural disasters in the short term, resulting in no significant change in the level of income inequality. Moreover, the study identifies unemployment insurance as a crucial aspect in mitigating these impacts. However, contrary to these findings, Wang and Zhao (2023) discovered that disasters elevated the level of income inequality and expenditure inequality.

Furthermore, a study by Rodriguez-Oreggia et al. (2013) in Mexico discerns that the potential for devastation arising from storms as significant shocks can elevate employment rates, particularly within blue-collar occupations entwined with reconstruction efforts. Spencer and Polachek (2015), with a congruent case study, unveil a negative correlation between agricultural productivity and storms, notably affecting above-ground crops. This evidence buttresses the adverse impact of disasters on the

overall labor market equilibrium in developing countries. An investigation conducted on Indonesian households by Kirchberger (2017) indicates that natural disasters result in an upswing in labor demand for reconstruction endeavors, consequently driving local wages upward and ultimately depleting skilled labor in the trade sector. The thinning of the labor force implies that the local labor market conditions are affected due to the weakening of tradable sectors, and the region's competitiveness in terms of output and export growth is significantly compromised. This amalgamation of empirical findings offers a comprehensive understanding of the intricate labor market dynamics in the wake of natural disasters, underscoring the multifaceted repercussions across diverse sectors and trade competitiveness.

However, the impact of natural disasters on the labor market potentially holds positive aspects as the reduced expectation of physical capital returns can induce a substitution effect on human resources (Skidmore and Toya, 2002). In essence, there is an argument that natural disasters can boost economic growth rates because when physical capital is damaged or destroyed, there may be a higher demand for labor after the natural disaster, leading to a relative increase in human capital (Skidmore & Toya, 2002; Tran & Wilson, 2023). These contrasting views necessitate a thorough investigation to address key questions concerning the relationship between labor market outcomes and natural disasters.

RESEARCH METHOD

The objective of this research is to assess the impact of disasters on the potential emergence of the middle class in Indonesia. Consequently, the logistic model is employed, and estimation is conducted using the maximum likelihood method. Logit regression is used to model binary (1 and 0) or dichotomous dependent variables. Compared to another method such as probit regression, logit basically provides similar results, while the choice between them depends on the availability of software and the ease of interpretation (Gujarati, 2011). Meanwhile using Linear Probability Model (LPM) which uses the Ordinary Least Square concept will result in the emergence of abnormal error distribution problems and heteroscedasticity violations. In essence, the equations employed in this analysis can be articulated as follows:

$$ln\left[\frac{(middle\ class)}{1-\pi(middle\ class)}\right] = \alpha_0 + \alpha_1 Disaster\ Risk\ Index_i + \psi X_i + \varepsilon_i \quad (1)$$

$$ln\left[\frac{\pi(formal\ worker)}{1-\pi(formal\ worker)}\right] = \beta_0 + \beta_1 Disaster\ Risk\ Index_i + \psi X_i + \varepsilon_i \quad (2)$$

The primary objective of equation (1) is to address the impact of disasters on the likelihood of individuals entering the middle class. The second model aims to ensure the consistency of results obtained from the first equation. Middle-class employment is considered part of the formal labor market. Consistency in the impact of natural disasters on the provision of decent employment in Indonesia is indicated by the coefficient sign α1= β1. Additionally, regarding the econometric framework, the Middle-Class Worker variable serves as a binary indicator denoting an individual's classification as a middle-class worker, which is determined by their income level. A person is identified as a middle-class worker (Y=1) if their present income meets or exceeds the minimum standard for middle-class income, and (Y=0) if it falls below this benchmark. The classification of middle-class employment in this research aligns with the criteria established by The World Bank (2021), where the minimum income threshold for middle-class employment is determined according to the following formula:

Minimum Wage for Middle-Class Job = (3.5*Poverty Line*4)/1,5 (3)

Referring to equation (2), it is revealed that the minimum income threshold for middle-class workers in Indonesia is Rp 4,283,505. The Formal Worker variable is a dummy variable with a value of 1 when employed in the formal sector. Moreover, natural disasters in this study are characterized using the terminology established by the BNPB, known as the Disaster Risk Index. The disaster risk index is information on the level of vulnerability and resilience of each district/city in Indonesia to disaster events. The disaster risk index is calculated based on the following formula:

$$Disaster\ Risk\ Indek: Hazadr\ x\ \frac{Vulnerability}{Capacity}$$

The calculation of this disaster risk index involves assessing the hazard, vulnerability, and capacity components in each province and regency/city. The hazard component encompasses natural phenomena that can lead to disasters, such as earthquakes, volcanic eruptions, tsunamis, floods, and others. Vulnerability components include (1) physical conditions; (2) socio-cultural factors; (3) economic factors; and (4) environmentally vulnerable conditions. Capacity components consist of regional resilience elements like policies and institutions; education and training; logistics; mitigation, prevention, preparedness, and emergency response capacities; and recovery capabilities. The influence of each component (weight) in determining the disaster risk index is 40% from the hazard component, 30% from the vulnerability component, and 30% from the capacity component.

The coefficient vector (ψ) on the variable X acts as a control variable encompassing individuals' socio-demographic characteristics, including (1) individual character which includes age and several dummy variables such as marital status, area of residence, gender, and digital literacy; (2) dummy education level in which there is individual participation in formal and informal education. Formal education is reflected in the last education completed and categorized into four main groups, namely college/university graduates, high school graduates, junior high school graduates, and below (as the referent category). Informal education is reflected in the participation of workers in training activities; and (3) characteristics of the job in which it describes the conditions of the workplace. There are three main variables in this component, namely the employment sector, employment type, and employment status. The employment sector is a dummy variable consisting of nine main sectors of categories, namely agriculture, manufacturing, mining, trade and accommodation, construction, transportation, services, finance, and social (whereas the agriculture sector as reference variable). The employment category is a binary variable that encompasses nine primary occupations, including managerial roles, professionals, technicians and associate professionals, clerical support staff, skilled workers in agriculture, forestry, and fisheries, craftsmen and related trades workers, plant and machinery operators, and assemblers (whereas elementary occupations as reference variable). Employment Status is a dummy variable consisting of 4 employment statuses namely entrepreneur, employee, casual workers in agriculture, and casual workers in non-agriculture (as reference).

The dataset utilized in this investigation is sourced from the 2020 Indonesian National Labor Force Survey (Sakernas). Sakernas compiles data from individuals encompassing various indicators such as limited demographics, education, and the economy. Conducted annually by the Central Statistics Agency (BPS), Sakernas serves as a primary instrument for monitoring workforce dynamics. This survey collects continuous basic employment data and obtains data estimates on the number of employed people, the number of unemployed, and other employment indicators, as well as representative

developments at the national, provincial, and district/city levels. This survey uses employment concepts based on the 13th International Conference of Labor Statisticians (ICLS) and ICLS-19.

RESULTS

The following table 1 presents a statistical summary of the main variables in this research, including the following.

Table 1. Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Middle-Class Workers	0.188487	0.391102	0	1
Formal Workers	0.517637	0.499689	0	1
Disaster Risk Index	136.2482	15.68912	60.43	160.98
Age	40.84791	13.14317	15	98
Male Workers	0.642303	0.479323	0	1
Marital Status	0.725117	0.446456	0	1
University	0.135502	0.34226	0	1
Senior High Academic	0.206109	0.40451	0	1
Senior High Vocational	0.142319	0.349377	0	1
Training Participation	0.183189	0.386822	0	1
Migrant Workers	0.039138	0.193923	0	1
Live in City	0.488042	0.499858	0	1
Digital Literation	0.341008	0.474049	0	1
Employment Sector				
Agriculture, forestry, livestock, and fishing	0.234567	0.423728	0	1
Manufacturing	0.02185	0.146193	0	1
Mining and quarrying	0.120469	0.32551	0	1
Electricity, gas, and water supply	0.00722	0.084665	0	1
Construction	0.081959	0.274303	0	1
Trade	0.210734	0.407831	0	1
Transportation and communications	0.050746	0.21948	0	1
Finance	0.029467	0.169112	0	1
Social	0.242988	0.428889	0	1
Employment Type				
Managers	0.022871	0.149494	0	1
Professionals	0.093651	0.291343	0	1
Technicians and associate Professionals	0.037741	0.19057	0	1
Clerical support workers	0.070552	0.256076	0	1
Craft and related trades Workers	0.206602	0.404868	0	1
Skilled agricultural, Forestry and fishery workers	0.144916	0.352017	0	1
Processing and Craft Workers	0.114902	0.318904	0	1
Plant and machine Operators and assemblers	0.073611	0.261138	0	1
Elementary occupations	0.227507	0.419223	0	1
Employment Status				
Self-Employed	0.335774	0.472261	0	1
Employee	0.517637	0.49969	0	1
Casual workers in agriculture sector	0.070722	0.25636	0	1
Casual workers in non-agriculture sector	0.075867	0.264785	0	1

Table 1 shows that the proportion of middle-class workers is often very low, at approximately 18%. This indicates that middle class employment is still mostly out of reach in Indonesia. However, the number of individuals who are formal workers is relatively large, more than 50 percent. Furthermore, the majority of respondents reside in low-risk locations with an average disaster risk index of 136.2. Based on individual characteristics, the majority of respondents in this study were male workers, married workers, not migrant workers, primary education graduates, lived in villages, and tended not to use the Internet in their work. Meanwhile, from the employment aspect, the majority of respondents are workers in the agricultural and service sectors, employees, and entrepreneurs.

The findings related to the impact of disaster risk on an individual's probability of becoming a middle-class worker are presented in Table 2. Disaster risk has a negative association with people's opportunity to become middle-class workers. This means that those who reside in high-risk catastrophe areas are less likely to become middle-class workers even though they have a very small chance of 0.03 percent lower. These results are in line with several previous studies with almost similar discussions as those conducted by Belasen & Polachek (2008), Rodriguez-Oreggia et al. (2013), and Mendoza & Jara (2020). Research conducted by Mendoza and Jara (2020) also shows a positive impact between natural disasters and the level of informality. Workers in disaster areas have a higher chance of becoming informal workers. Research conducted by Kirchberger (2017) also produced the same findings where there was an increase in activity in the informal sector as a result of natural disasters. These two findings support the argument about the negative impact of disasters on an individual's chances of becoming a middle-class worker.

Table 2. Logit Regression for Middle-Class Workers

Dependent Variable: Middle-Class Workers	Basic Model		Control Employment Sector		Control Employment Type		Control Job Status	
	Coefficient	OR	Coefficient	OR	Coefficient	OR	Coefficient	OR
Disaster Risk Index	-0.003***	0.997	-0.003***	0.997	-0.003***	0.997	-0.003***	0.997
Age	0.040***	1.041	0.043***	1.044	0.039***	1.040	0.042***	1.043
Male Workers	0.612***	1.844	0.600***	1.822	0.599***	1.821	0.625***	1.868
Marital Status	0.567***	1.763	0.551***	1.735	0.542***	1.720	0.554***	1.740
University	2.168***	8.741	2.116***	8.297	1.884***	6.581	1.927***	6.869
Senior High Academic	1.123***	3.073	1.066***	2.903	1.000***	2.718	0.965***	2.625
Senior High Vocational	1.288***	3.624	1.237***	3.444	1.124***	3.076	1.108***	3.028
Training Participation	0.517***	1.676	0.488***	1.628	0.471***	1.602	0.471***	1.601
Migrant Workers	0.318***	1.375	0.326***	1.386	0.323***	1.381	0.325***	1.384
Live in City	0.413***	1.512	0.390***	1.478	0.411***	1.508	0.386***	1.471
Digital Literation	0.973***	2.646	0.917***	2.502	0.834***	2.302	0.847***	2.332
Employment Sector								
Manufacturing			1.970***	7.167				
Mining and quarrying			0.615***	1.850				
Electricity, gas, and water supply			0.551***	1.735				
Construction			0.167***	1.182				
Trade			0.303***	1.354				
Transportation & Communication			0.260***	1.296				
Finance			0.790***	2.204				

Social			0.463***	1.589				
Employment Type								
Managers					1.160***	3.190		
Professionals					0.353***	1.423		
Technicians and associate Professionals					0.797***	2.220		
Clerical support workers					0.318***	1.374		
Craft and related trades Workers					0.042	1.042		
Skilled agricultural, Forestry and fishery workers					-0.221***	0.802		
Processing and Craft Workers					-0.242***	0.785		
Plant and machine Operators and assemblers					0.401***	1.494		
Employment Status								
Self-Employed							1.064***	2.897
Employee							1.482***	4.403
Casual workers in agriculture sector							-0.55***	0.574
Constant	-6.323***		-6.678***		-6.167***		-7.411***	
	(0.066)		(0.070)		(0.068)		(0.085)	
Observations	312,180		312,180		312,180		312,180	
Standard errors in parentheses								
*** p<0.01, ** p<0.05, * p<0.1 OR = Odd Ratio								

The estimation is carried out again by examining the relationship between natural disasters and employment opportunities in the formal market in order to ensure the consistency of the impact of the disaster on the likelihood of individuals becoming middle class-worker. The difference between Tables 2 and 3 lies in the dependent variable, which represents distinct labor market outcomes, particularly reflected through formal employment indicators.

Table 3. Logit Regression for Formal Workers

Dependent Variable: Formal Workers			Control Employment Sector		Control Employment Type	
	Coefficient	Odd Ratio	Coefficient	Odd Ratio	Coefficient	Odd Ratio
Disaster Risk Index	-0.002***	0.997687	-0.002***	0.998273	-0.002***	0.997682
Age	-0.032***	0.968591	-0.036***	0.964333	-0.033***	0.967411
Male Workers	0.102***	1.139767	0.381***	1.46407	0.201***	1.222607
Marital Status	0.035***	1.025106	-0.006	0.994287	-0.036***	0.965044
University	2.093***	7.467193	1.317***	3.731303	0.814***	2.255968
Senior High Academic	0.621***	1.875951	0.449***	1.565962	0.430***	1.537049
Senior High Vocational	0.916***	2.124804	0.654***	1.923744	0.613***	1.84662
Training Participation	0.547***	1.664523	0.250***	1.284469	0.321***	1.378909
Migrant Workers	0.098***	1.092612	0.129***	1.137162	0.157***	1.170121
Live in City	0.422***	1.537676	0.334***	1.396277	0.408***	1.503592
Digital Literation	0.698***	1.969986	0.501***	1.650764	0.397***	1.487614
Employment Status						
Manufacturing			1.473***	4.363376		
Mining and quarrying			1.235***	3.437157		
Electricity, gas, and water supply			1.647***	5.188839		

Construction			0.586***	1.796804		
Trade			0.177***	1.193433		
Transportation & Communication			0.203***	1.225196		
Finance			1.933***	6.910903		
Social			2.241***	9.404789		
Employment Type						
Managers					0.428***	1.534922
Professionals					2.097***	8.14523
Technicians and associate Professionals					1.172***	3.229693
Clerical support workers					3.476***	32.31527
Craft and related trades Workers					-0.808***	0.445945
Skilled agricultural, Forestry and fishery workers					-1.716***	0.179775
Processing and Craft Workers					-0.376***	0.686807
Plant and machine Operators and assemblers					0.428***	0.774972
Constant	0.588***		-0.024		1.162***	
	(0.042)		(0.046)		(0.045)	
Observations	312,180		312,180		312,180	

The results show that there is a negative relationship between natural disasters and the chances of workers becoming formal workers (see Table 3). This indicates that the likelihood of obtaining formal employment is often lower for workers in high-risk areas. On the other hand, their chances of becoming informal workers are getting bigger. It can be said that areas with high disaster risk tend to have a lower proportion of decent work.

DISCUSSION

Figure 3 can explain the negative impact of disaster risk on the availability of decent work or middle-class work in this case can be understood by utilizing some basic economic theories such as those developed by Solow and the support of several related kinds of literature. Areas with a high level of disaster risk tend to have high investment costs and low savings ratios. This occurs because of the tendency of costs incurred for conservation or similar expenditures to reduce the impact of disasters. According to the theory of slow growth, low savings, and high investment costs will lead to a lower level of output. The implication in the labor market is the low demand for decent work. With the same level of supply, the level of demand for inputs or in this case labor becomes lower. This has led to greater competition in the formal labor market and has resulted in fewer middle-class job holders. Many workers will maneuver to the informal sector to maintain their survival.

Figure 3. Linkage Between Disaster Risk and Middle-Class Job

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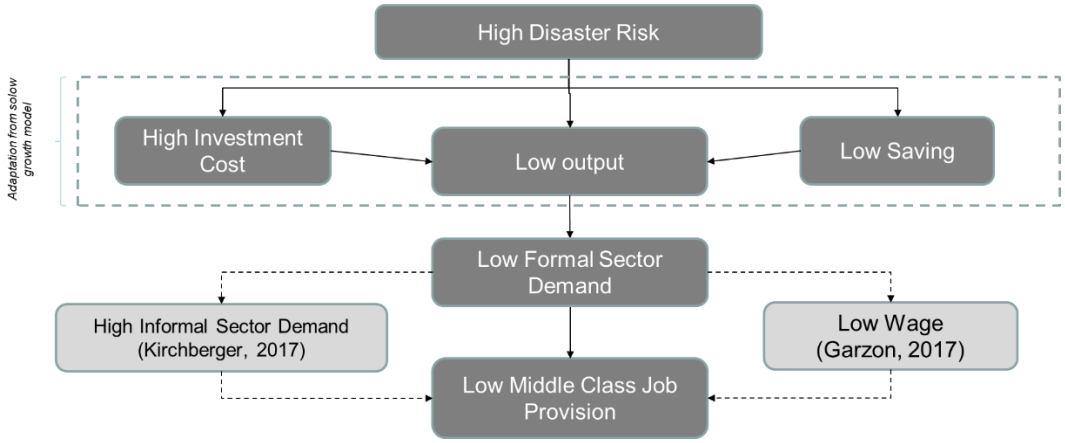

Source: Kirchberger, 2017; Garzón, 2017; Ehrenberg and Smith, 2012; Todaro and Smith, 2012

The impact of natural disaster risk on the availability of middle-class jobs for society can also be explained through several mechanisms. First, areas with a high disaster risk index will feel a relatively greater impact when a disaster occurs, including extensive damage to physical infrastructure, such as factories, commercial buildings, and agricultural land. This will not only disrupt the production process but also mobility in the economy. In addition, if the interrelationship between input and output in one area is very large, disruption of one company's production process will have a big impact on other companies, and the negative impacts will accumulate and cause many community groups to be affected. This sets up a vicious cycle that lowers society's purchasing power, the economy's aggregate demand, the need for labor, and ultimately leads to higher unemployment or a shift to the unorganized sector (Kirchberger, 2017; Mendoza & Jara, 2020; Asrofi et al., 2023).

Second, investment confidence in areas with high disaster risk is shallow. Investors, both domestic and international, are often hesitant to allocate capital to areas with high disaster risk due to high levels of uncertainty and perceived risk. This uncertainty creates a volatile investment environment where investors will find it difficult to measure the feasibility and potential profits of their investments. The decline in investment confidence after natural disasters is an important aspect that significantly impacts job opportunities and economic recovery efforts. Low investment means reduced opportunities for the business world to expand, innovate, and create better jobs. Sectors that depend on investment, such as infrastructure development, manufacturing, and technology, experienced slowing growth, leading to stagnation in job creation and economic activity.

Third, areas with high disaster risk will tend to have lower levels of productivity. Several previous studies have found that areas with high disaster intensity tend to have fluctuating economic dynamics, and lower economic growth and productivity (Nordhaus, 2010; Shabnam, 2014; Botzen et al., 2019). Apart from that, this problem also occurs because natural disasters tend to have a disproportionate impact on society and are more detrimental to lower-income groups (Tasri et al., 2021; Lu et al., 2022). As previously explained, areas with a higher risk of disaster tend to increase the likelihood of individuals becoming workers in the informal or low-wage sector. This causes competition in the informal sector job market to become greater because the number of new workers available increases while demand decreases. This will put negative pressure on income levels. A lower income further worsens a person's chances of becoming a middle-class member of society in the job market.

In facing the job market challenges faced by regions with high disaster risk, the government needs to pay attention to how to strengthen infrastructure aspects, maintain people's purchasing power, and reduce investment risks. One important aspect is the development of disaster-resistant and sustainable infrastructure in vulnerable areas. This includes investing in infrastructure that is resilient to natural disasters, such as flood-resistant buildings, earthquake-resistant buildings, and strong transportation networks that can withstand extreme weather events. On the other hand, to overcome the challenge of low trust in investment, there needs to be good synchronization between the government, business actors, and society. One important aspect is how the government can promote stability, transparency, and resilience in disaster-prone areas. On the other hand, it is necessary to increase the adaptive capacity of communities and business actors in order to reduce vulnerability in disaster risk areas. This involves establishing and strengthening community networks that can mobilize quickly in the event of a disaster, ensuring a rapid and coordinated response to emergencies. Additionally, improving disaster preparedness and management capabilities in local institutions is critical to minimizing the impact of disasters on livelihoods and economic activities. By investing in training, resources, and coordination mechanisms, local governments and organizations can improve their capabilities to mitigate risks, respond effectively to crises, and facilitate recovery efforts.

The following discussion describes several socio-demographic variables that affect middle-class workers. Firstly, age positively correlates with the chance of becoming a middle-class worker. The findings indicate that your chances of becoming a middle-class worker increase with age. On the other hand, youth are less likely to work in the middle-class. This phenomenon indicates that young people are not as competitive in the middle-class job market. Several factors related to work experience and professional skills are the barriers to youth in the labor market. This is in line with the findings of Ristanto et al. (2022) that young workers tend to work below living wage standards.

The estimation results in Table 2 also demonstrate the persistence of gender bias in Indonesia's labor market. Compared to women, men have a 1.8 times higher chance of becoming middle class. Because women generally have relatively restricted access to the labor market, it is difficult for them to find middle-class positions or better jobs compared to men workers. Women typically select more flexible jobs since they have greater obligations in the home, from childrearing to caring for parents (Shehu & Nilsson, 2014). This choice potentially worsens women's work experience and formal working hours which creates a barrier and lowers their prospects of obtaining middle-class employment.

A worker’s place of residence also plays a role in the career maneuver of an individual. According to Table 2 findings, those who live in urban regions have a 1.5 times higher chance of becoming middle-class workers than people who live in rural areas. This phenomenon seems to be relatively logical given that urban areas typically feature a high concentration of government and commercial activity in addition to a number of highly valuable industrial centers. As a result, employees in metropolitan areas are more likely to work in high-paying jobs. Moreover, workers in rural areas often engage in agriculture-based jobs, which typically offer low added value and are susceptible to adverse weather conditions and other climatic shocks.

A person's level of education also plays a critical role in accessing middle-class jobs. The estimation's findings indicate that the likelihood of becoming a middle-class worker increases with an increase in education level. Table 2 shows that people who have completed higher education or a university degree—which is the highest level of formal education—are around eight times more likely to work in the middle class than people

who have completed a lower education degree. This is consistent with earlier studies that show a low degree of schooling is strongly associated with a low-quality initial job, lower earnings, and a higher chance of experiencing unemployment at some point in one year later (O'Higgins, 2017; 2019).

Middle-class worker status is also influenced by individual factors such as migratory status and digital literacy. People from migrant backgrounds are 1.3 times more likely to become middle-class. Furthermore, people who utilize the internet or have digital abilities at work are 2.6 times more likely to become middle-class workers. The financial and manufacturing industries provide high opportunities for middle-class employment. The likelihood of becoming a middle class is twice for those in the finance sector and seven times for those in the manufacturing sector.

CONCLUSION

This study seeks to investigate the likelihood of individuals attaining middle-class status in regions with high disaster risk. Using the National Labor Force Survey 2020 and BNPB, this research found that individuals living in areas with high disaster risk statistically have a lower probability of advancing to middle-class status. Apart from that, the opportunity to get formal workers is also getting lower, making more it difficult for people to reach the middle-class level in society. These findings underline the importance of paying attention to aspects of environmental vulnerability for better socio-economic outcomes in society.

Furthermore, this study offers some significant insights into the sociodemographic traits that are believed to influence an individual's likelihood of becoming middle class. A higher degree of formal and informal education is crucial for promoting young people's involvement in the middle-class. An individual's chances of becoming a middle-class worker are increased by living in an urban region. In addition, marriage status and gender play a significant role in influencing middle-class participation; married people and men are more likely to be middle-class workers.

In overcoming the labor market challenges faced by regions with high disaster risk, careful policy steps are needed that focus on strengthening capacity and reducing the risk of high investment costs. The development of disaster-resistant infrastructure and sustainable economic diversification in areas with high disaster risk needs to be improved. it is critical to develop community networks that can respond quickly to catastrophes, enhance local institutions' preparedness and disaster management capabilities, and increase community capacity to deal with disaster threats. Another priority is the need to increase access to social protection services and promote economic recovery in high-risk areas for disasters. Those who have lived in areas where there is a high risk of disasters and have personally experienced their devastating effects frequently face long-term repercussions.

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DECLARATION OF CONFLICTING INTERESTS
The authors report there are no competing interests to declare.

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