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TOURISM VULNERABILITY TO DISASTER: IMPACT OF EPIDEMIC, NATURAL DISASTER, AND TERRORISM (EVIDENCE FROM INDONESIA)

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Abstract

This study aims to explore the impact of multiple disasters, such as pandemics, natural disasters, and terrorism, on inbound tourists in Indonesia. Using a panel data approach, we studied the impact of these disasters by analyzing data regarding international tourist flow from 19 countries and nine ports of entry from 2008 to 2020. The results showed that different types of disasters affected inbound tourists differently in terms of magnitude and significance. In addition, some disasters had a longer-lasting impact, which can be seen from the significant negative impact in the year following the disaster. We also uncovered an impact that varied among tourist origin countries according to their responsiveness to the disaster. The findings imply that sustainable tourism development can not be achieved without understanding how disasters affect tourism.

Keywords: *foreign tourist arrivals; panel, epidemic; natural disaster; terrorism.*

JEL Classification: *Q54, L83*

INTRODUCTION

The tourism industry, especially international tourism, is admittedly vulnerable to catastrophic events (Cró & Martins, 2017). The decline in foreign tourist arrivals due to Covid-19 has shown that the tourist sector could be shaken at any time by external factors. Disasters may lower tourist visitation in the affected areas and the surrounding areas (Bhati et al., 2016; Rosello et al., 2020). In recent years, the tourism industry has experienced various disasters both natural and manmade. Under these circumstances, sustainable tourism management must understand, manage, and respond to disaster risk as an integral component of their activities (Shakeela & Becken, 2015).

Equally in Indonesia, disasters are a challenge to tourism development. Tourism is designated in the 2020–2024 Medium-term National Development Plan as a sector that can increase economic added value. Over the next five years, the tourism development strategy will improve tourism destinations and enhance industry competitiveness. The government continues to improve accessibility, attractions, and amenities by developing ten priority and eight additional tourist destinations, and have set a target for 2024 of 22.3 million foreign tourist arrivals. On one hand, this ambitious target is achievable because Indonesia has a wealth of tourist resources in terms of natural and cultural diversity. However, as a disaster-prone area, disasters may occur at any time to hinder the achievement of visitation targets. For the four years before Covid-19, the number of foreign tourist arrivals to Indonesia was consistently below target.

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Indonesia has undergone various disasters such as epidemics, natural disasters, and terrorism. The Indonesia National Agency for Disaster Management (2014) described several factors that make Indonesia prone to various disasters. Anthropogenic disasters such as epidemics may arise in line with the increasing population and uncontrolled housing. Epidemics from other countries potentially reach Indonesia due to the growing human mobility in and out of Indonesia. The threat of natural disasters such as earthquakes and volcanic eruptions is a consequence of Indonesia's location in the so-called "ring of fire". Indonesia also faces social disasters like terrorism due to the emergence of extremist groups due to historical, religious, and political factors (Galamas, 2015).

As per the most recent one, the world has been facing the Covid-19 pandemic, the most significant health disaster of the 21st century. The severity of the spread of Covid-19 has provided shocks to the economy, especially the tourist sector. UNWTO (United Nations World Tourist Organization) has reported that the global flow of international tourists in 2020 reached only 394 million people, down 73% from the previous year's 1.4 billion. Meanwhile, according to the Indonesian Central Statistical Agency (BPS), 2020 saw only around 4 million foreign tourist visits to Indonesia, down 75% from the 16 million recorded in 2019. Although the government continues to strive to control extremist groups, they continue to revive and regroup (Fitriani et al., 2018), so that the threat of terrorist attacks remains to this day.

The vulnerability of tourism to disasters can be understood by considering how tourists make travel decisions. Destination image is the primary consideration in selecting the destination, and disaster events potentially tarnish that image from the perspective of security. Tourist decision-making is closely related to the potential risks experienced on vacation (Henderson, 2007), such as financial, health, physical, crime, terrorism, social, psychological, and natural disaster risks (Floyd & Pennington, 2004). Every tourist has a limit to risk tolerance, so security is a fundamental consideration when selecting a destination, especially for international travel (Wang, 2014), and tourists are likely to reconsider their travel plans if a disaster hits the destination they choose. When the risk is considered too significant, the final decision for tourists may be in the form of cancellation, rescheduling, or moving to another safer destination. The aggregate of these individual decisions will affect the overall level of tourist visitation.

The vulnerability of tourism has attracted various researchers to explore the relationship between disaster events and the level of tourist visitation. Studies have examined the impact of both single and multiple disaster events. The scope of the research also varied geographically, from the single-destination to global scales. Research conducted based on the impact of a single disaster event has included studies of the SARS epidemic (Mao et al., 2010), volcanic eruptions (Jónsdottir, 2011), earthquakes (Zhang & Ceng, 2019), tsunamis (Blažin et al., 2014), and terrorism (Corbet et al., 2019). Meanwhile, research conducted based on multiple disaster events includes studies by Bhati (2016), Tony & Jacky (2020), Barbhuiya & Chatterjee (2020), and Rosello et al. (2020).

Several studies related to the impact of disasters on foreign tourist arrivals in Indonesia have been carried out; however, these are still limited in number, especially those studying multiple disaster events. Studies on the effect of a single disaster event

include research on terrorism (Henderson 2003; Smyth et al., 2009) and climate-related natural disasters (Susanto et al., 2020). Research on the impact of multiple disaster events has been conducted by Rindrasih et al. (2018) and Purwa and Atmanegara (2020). Rindrasih et al. qualitatively analyzed fluctuations in foreign tourist arrivals related to terrorism, epidemics, tsunamis, and earthquakes. Using time-series data, Purwa and Atmanegara found that catastrophic events such as terrorism, disease outbreaks, and volcanic eruptions generally lowered visitor numbers at three ports of entry, namely Bali, Jakarta, and Batam.

Several Indonesian tourist destinations faced different types of disaster threats at particular times. Therefore, it is crucial to compare the impact of various disasters on tourist areas to formulate appropriate strategies for increasing tourism resilience (Barbhuiya & Chatterjee, 2020). Given the absence of quantitative research using panel data, we conducted more in-depth research on the impact of a series of different disaster events, namely epidemics, natural disasters, and terrorism. We expanded the unit of analysis by using 19 tourist-origin countries and nine entry ports. Adopting a panel data approach, we conducted this study to describe the heterogeneous effect of each disaster event on foreign tourist arrivals to Indonesia.

LITERATURE REVIEW

Disaster

To provide an in-depth understanding of the concept of disaster, various parties have defined the term. In brief, Twigg (2004) defined disaster as damage and disturbance that exceeds the capacity of the affected community to cope. UNISDR (United Nations Office for Disaster Risk Reduction; 2009), put forward a broader definition of disaster as a severe disruption to community functions that causes widespread human, material, economic, or environmental losses and impacts that exceed the capacity of affected communities to cope.

Disaster management in Indonesia has been regulated through powers granted by Law Number 24 of 2007 (Law 24/2007). The government passed the law considering geographical, geological, hydrological, and demographic conditions that make the country more susceptible to disasters, which the law groups into three types: natural disasters, non-natural disasters (such as epidemics), and social disasters (for example, terrorism).

The US CDC (Centers for Disease Control and Prevention; 2006) defines epidemic as an increase in disease cases to levels exceeding normal conditions in the population in a specific area. Meanwhile, the WHO (World Health Organization) defines an epidemic as the occurrence of disease cases or other health-related events that exceed normal expectations. If a disease spreads widely in various countries or continents, its status will increase from epidemic to pandemic. Meanwhile, if a disease occurs continuously in an area, it is called endemic. According to Merrill (2017), the spread of an epidemic can be divided into two types, namely common-source epidemic and propagated epidemic. Common-source epidemics arise from specific sources such as cholera, caused by fecal contamination of food and water. Meanwhile, propagated

epidemics occur from infections transmitted from one person to another, such as the flu and the coronavirus.

Natural disasters are catastrophes caused by uncontrollable natural events, sometimes called "Acts of God" (Shaluf, 2007). Hydrometeorological phenomena are natural phenomena related to the atmosphere, hydrology, and oceanography, whereas geological phenomena are related to the nature and structure of the earth, and both can cause natural disasters, although geological disasters like earthquakes and volcanic eruptions pose a greater threat. Earthquakes are shocks to the earth's surface caused by movements in the outer layer (NASA, 2019). An earthquake with an epicenter in the sea can be followed by another natural disaster like a tsunami. Volcanic eruptions are natural phenomena that occur in active volcanoes when magma penetrates the earth's crust and exits to the surface.

Terrorism is the prime example of a human-caused disaster. While Anshori et al. (2019) has found that every country defines terrorism according to its own perspectives, dynamics, challenges, and needs, orthodox terrorism theory categorizes terrorist acts as functional, symbolic, or tactical (Franks, 2006). Functional terrorism is expected to provoke reactions from the state, supporters, and even the population in general, while symbolic terrorism is an attempt to intimidate or terrorize targeted individuals. Meanwhile, tactical terrorism can be understood as a limited means of achieving short-term gains or a part of a broader strategic initiative. Terrorism has created threats in various forms, such as casualties, physical damage, and psychological impacts.

Relationship Between Disaster and Tourist Visitation

Like other consumers, tourists face uncertainty when they cannot predict the consequences of a purchase. Tourists may face various risks ranging from minor risks such as feelings of disappointment because the destination was not as expected to serious risks that threaten the safety and security of tourists. Floyd and Pennington (2004) identified eight types of tourist risk: financial risk, health risk, risk of accident, risk of being a victim of crime, risk of becoming a victim of terrorist attack, risk of natural disasters, risk of psychological distress, and social risks. Various disaster events may trigger several risks related to the security and safety of tourists, such as epidemics, natural disasters, and terrorism. Tourists usually try to choose safe destinations to minimize the potential risk. Security is particularly significant in international tourism. If tourists consider a destination unsafe, this negative image will reduce their desire to visit (Donaldson & Ferreira, 2009).

Sönmez and Graefe (1998) developed a detailed model of how the element of risk affects the tourist decision-making process over multiple stages, especially for international tourist activities. Along with considering consumer behavior, Sönmez and Graefe used prospect theory and information integration theory.

Prospect theory describes how individuals decide on various alternatives involving risk and uncertainty. Sönmez and Graefe explained that prospect theory could shed light on how tourists decide which destinations to visit. The selection process is carried out by evaluating various alternative places based on their level of safety before eliminating others that are considered risky and settling on one. In this process, individual risk perceptions affect the attractiveness of the destination being evaluated. Each tourist has their own assessment of the level of risk they can tolerate. Risk-averse people tend to

choose destinations they perceive as safe. In contrast, risk seekers seem not to pay too much attention to the security aspect of a destination.

Information integration theory (IIT) describes how individuals integrate information from multiple sources to make a holistic assessment. IIT explores how attitudes are formed and changed by integrating new information with existing cognitions or thoughts in individuals (Anderson, 2016). Sönmez and Graefe explained that tourists' impressions, evaluations, and ratings of a destination already decided on could change. Changes may occur due to events such as terrorist attacks or natural disasters to the tourist site. Tourists will likely integrate knowledge of these events into the decision-making process, potentially changing their travel plans.

Rosello et al. (2020) explained that there are three reasons a disaster might lower visitor numbers. The first is that a destination cannot be visited because of physical damage to tourist sites and infrastructure such that tourist activities cannot be run. Second, there is a perception that a destination affected by a disaster is unsafe. Third, tourists avoid disaster-hit destinations due to ethics. Thanks to Covid-19, we know another reason that disasters can reduce tourism: policies to suppress the epidemic, like lockdown and international travel restrictions.

On the other hand, disasters may trigger the arrival of people for purposes such as visits with friends or relatives, humanitarian missions, or activities called dark tourism. According to the UNWTO definition, people arriving for these purposes are still recorded as tourists even though they are relatively few in number compared to those travelling for vacation or business purposes.

The relationship between disasters and foreign tourist arrival has been examined through various empirical studies. Mao et al. (2010), for example, conducted research into the SARS epidemic in 2003. In this study, the SARS epidemic negatively affected foreign tourists' arrival to Taiwan from Hong Kong, Japan, and the United States. Research related to the impact of natural disasters was conducted by Huang and Min (2001) and Jónsdottir (2011). Huang and Min (2001) revealed that the earthquake in Taiwan in 1999 had reduced tourist visitation up to 11 months after the disaster. Jónsdottir (2011) demonstrated the eruption of Mount Eyjafjallajökull in Iceland in May 2010 brought down numbers of both flights and tourists by 17.5%. Meanwhile, research related to the impact of terrorism was carried out by Smyth et al. (2009) related to the Bali bombings of 2002 and 2005. Smyth et al. found that the two terrorist attacks had reduced tourist arrivals to Bali, although only temporarily.

METHODOLOGY

Model Specification

Epidemics, natural disasters, and terrorist events cause a shock in tourism demand that causes a structural break, as demonstrated empirically by Cró and Martin's 2017 study. We explored how these shocks affect tourism bilaterally between Indonesia and the tourist origin country. The dependent variable is the number of foreign tourists visiting Indonesia, while the independent variable is multiple disasters, i.e., epidemic, natural disasters, and terrorist attacks from 2008 to 2020. We adopt the tourist demand estimation

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model by combining economic and non-economic determinants. The specific model used in this study is as follows:

$$\ln(TAijt + 1) = \alpha + \beta_1 EP_t + \beta_2 ND_{jt} + \beta_3 TER_{jt} + \beta_4 \ln(TA_{ijt-1} + 1) + ACS'\gamma + CTRL'\gamma + e$$

TA_{ijt} was the number of international tourists arriving from country i entering port j in year t. Following a study by Yudhistira et al. (2020), we added one to this number since there was zero visitation in several ports to avoid reducing observations. Due to data availability, the research is focused on foreign tourists entering through nine entry ports (Bali, Jakarta, Batam, Medan, Padang, Surabaya, Lombok, Manado, and Makassar) from 19 countries (Malaysia, Singapura, Thailand, the Philippines, China, Hong Kong, Japan, South Korea, Taiwan, India, Australia, New Zealand, Netherland, the United Kingdom, France, Germany, Russia, the USA, and Canada).

EP_t, ND_{jt}, and TER_{jt} are variables of interest in capturing disaster events. EP_t represented vector variables for epidemics in year t consisting of 2 dummy variables: swine flu and the Covid-19. Limiting our consideration to epidemics declared a pandemic by WHO, we assigned a value of 1 to this variable for the years 2009–2010 (swine flu) and 2020 (Covid-19). ND_{jt} represented vector variables for major natural disasters consisting of two dummy variables: earthquake and volcano eruption. We also limited our consideration to natural disasters caused by geological phenomena and resulting in significant damage. The assigned value was 0, except for the closest entry port in the year of the disaster, when the value was 1. TER_{jt} represented dummy variables for terrorist attacks. The value was 1 for the year and entry port closest to the attacks, and 0 in other cases. Major disaster events that are incorporated into the model are as follows:

Table 1 List of Major Disaster Event in Indonesia

Disaster Type	Disaster Event	Year	Entry Port
EPIDEMIC	1. Swine Flu	2009-2010	All Ports
	2. Covid-19	2020	All Ports
NATURAL DISASTER	3. Earthquake		
	West Sumatera Earthquake	2009	Padang
	Lombok Earthquake	2018	Lombok
	4. Volcano Eruption		
	Mount Lokon Eruption	2011 & 2015	Manado
	Mount Rinjani Eruption	2015	Lombok
	Mount Agung Eruption	2017	Bali
TERRORISM	5. Terrorism		
	Jakarta Bombing	2009, 2016, & 2017	Jakarta
	Surabaya Bombing	2018	Surabaya

To determine whether the variables of earthquakes, eruptions, and terrorism affect the planning of travel trips in the following year, each of these disasters increased by 1 the value of the corresponding variable for the previous year (t-1).

We included TA_{ijt-1} in the model as the number of international tourist arrivals from country i entering port j in the previous year (t-1), adding 1 to avoid reducing the number of observations. As disasters tend to decrease the number of tourist arrivals, we

included several government policies to attract tourists by enhancing the accessibility of tourism, represented by ACS′γ, a variable vector consisting of additional direct flights (DirectFlight) and visa exemption policy (VisaFree) for particular countries. Since 2013, the Government has approved other international direct flights to Lombok originating from Singapore, Hong Kong, and Australia. Because these are international hubs, we expect the program to increase foreign tourist arrivals to Lombok from all countries. Additional international direct flights have also been made to Manado since 2016, although they are still limited to flights originating from China. The value of DirectFlight was 1 for Lombok since 2013, 1 for Manado since 2016 for tourists from China, and 0 for all other cases. Meanwhile, the government has granted additional visa exemptions to certain countries since 2015 and 2016 on the basis of Presidential Decrees Number 69/2015, Number 104/2015, and Number 21/2016. The value of VisaFree was 1 for tourists coming from a country granted visa-free visits since 2015 or 2016.

CTRL′γ represented the vector of dummy and economic control variables. We used political crisis (POLITIC) as a dummy control variable. Like disasters, crises also potentially lower tourist arrival numbers. Considering Indonesia's relatively stable political conditions in the 2008–2020 period, we used the political conditions from the tourist origin country. Thailand and Hong Kong underwent long political crises in 2014 and 2019, respectively. We argued that people experiencing political crises in their homeland would focus on domestic affairs and be less interested in vacationing abroad. The value of POLITIC was 1 for tourists from Thailand in 2014, 1 for tourists from Hong Kong in 2019, and 0 otherwise. We excluded the global financial crisis in 2008–2009 because we already used GDP per capita to capture the economic performance of each origin country. We followed other studies to include several economic control variables such as GDP per capita (Habibi, 2017; Nahar et al., 2019; Muryani et al., 2020), foreign exchange rate (Nugroho et al., 2014; Azhar et al., 2018; Tung, 2019), and jet fuel price (Xu et al., 2018); Hopken et al., 2017).

β_1–β_3 measured the average impact of the epidemic, natural disaster, and terrorism events on foreign tourist arrivals. The impact can vary by country of origin, and each tourist weighs up risk when considering a destination (Amara, 2012). The behavior of tourists depends on their culture of origin (Suvantola, 2002). Individuals from different cultural backgrounds use approach decision-making differently (Garg, 2012), and some countries may be more sensitive to disaster events than others. Following this, we try to estimate the variation in the impact of disasters on foreign tourist's visitation across the country of origin based on an analysis of the average impact (*base result*).

As the data are three-dimensional panel data (varying across countries, ports, and years), we began the analysis by choosing the best model. Based on the Chow and Hausman tests, the fixed effect is the best model for this study. Afterward, classical assumption tests were carried out to ensure that the regression model produces estimates that meet the BLUE (best linear unbias estimation) assumptions. Based on the test, the model still suffered from heteroskedasticity and autocorrelation. Considering the presence of such conditions, finally, we used a robust fixed-effect method for the analysis.

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Source of Data

This study used secondary data from several sources, including Indonesian government institutions, international organizations, legal documents, media outlets, and newspaper articles. The number of foreign tourist arrivals was made available by BPS. The disaster events data were collected from the WHO for epidemics, the Meteorological, Climatological, and Geophysical Agency (BMKG) for earthquakes, the Center for Volcanology and Geological Hazard Mitigation (PVMBG) for volcanic eruptions, and various news media for terrorism data.

Tourism accessibility policies were drawn from government regulations in the case of visa exemption policy and various news media for the additional direct flight. Economic control variables, namely GDP per capita and foreign exchange rate, were constructed from data supplied by the International Monetary Fund, while jet fuel prices were collected from US Energy Information and Administration System. Another dummy control variable, the political crisis in the tourist country of origin, was obtained from various news media.

RESULTS AND DISCUSSION

We conducted the regression with the average impact of multiple disasters (base result), followed by estimating the effects across country origins (country–origin result).

Base Result

Table 2 reports estimated base results describing the average impact of every variable. We conducted a stepwise regression by including additional control variables in subsequent columns as a robustness check.

Table 2 Effect of Disaster on Foreign Tourist Arrival (Base Result)

Variables	(1)	(2)	(3)
Swine flu	-0.00397	-0.00688	-0.00432
	(0.0366)	(0.0365)	(0.0424)
Covid-19	-1.957***	-1.960***	-1.980***
	(0.0989)	(0.0995)	(0.0901)
Earthquake	-0.291***	-0.293***	-0.277***
	(0.0984)	(0.0988)	(0.0972)
$Earthquake_{t-1}$	-0.390***	-0.386***	-0.395***
	(0.110)	(0.108)	(0.106)
Eruption	-0.0884	-0.0929*	-0.0910*
	(0.0549)	(0.0548)	(0.0547)
$Eruption_{t-1}$	0.00944	0.00543	-0.00405
	(0.0351)	(0.0347)	(0.0352)
Terrorism	-0.0164	-0.0191	-0.0171
	(0.0370)	(0.0367)	(0.0375)
$Terrorism_{t-1}$	0.0456	0.0476	0.0400
	(0.0378)	(0.0350)	(0.0360)
$lnTA_{ijt-1}$	0.522***	0.524***	0.510***
	(0.0541)	(0.0544)	(0.0566)

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DirectFlight	0.724***	0.725***	0.739***
	(0.121)	(0.122)	(0.118)
VisaFree	0.162***	0.161***	0.182***
	(0.0295)	(0.0294)	(0.0463)
POLITIC		-0.265**	-0.258**
		(0.120)	(0.117)
lnGDP			0.241**
			(0.111)
lnExcRate			0.195
			(0.129)
lnJetFuel			-0.0710
			(0.0576)
Observations	2,223	2,223	2,223
R-squared	0.612	0.614	0.615
Prob > F	0.0000	0.0000	0.0000
Number of Country_Portnum	171	171	171

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The Impact of Epidemics

Table 2 reveals significantly different negative effects of both the swine flu and Covid-19 pandemics on tourist numbers. Only the impact of the Covid-19 pandemic was significant, reducing foreign tourist arrivals by up to 198% compared to the period before Covid-19 hit.

The different results could be explained due to differences in the character of both the pandemics themselves and policy responses to them. Covid-19 is considered much more contagious and deadly than swine flu (Bernhard, 2020). The CDC estimates the swine flu mortality rate to reach only reach 0.02%, while for Covid-19 the mortality rate is close to 2% (Brigman, 2020). The swine flu pandemic could be adequately controlled because effective anti-viral treatments were already available, whereas there were no such treatments for Covid-19 until the discovery of a vaccine (Costa et al., 2020). These differences in character prompted differing policy responses. During the swine flu pandemic, the WHO (2009) did not recommend imposing a travel ban because of potential significant disruption to the global economy. Several countries with high rates of swine flu only implemented social distancing policies, while, the Covid-19 pandemic has forced almost all countries to impose policies like lockdown and international travel restrictions.

According to study by Costa et al. (2020), swine flu cases in Indonesia occur in relatively controllable numbers. There were no lockdowns or international travel restrictions. The tourism sector continued to run so that in this study, it was found that the swine flu pandemic had no significant effect on inbound tourists. However, other studies found that the swine flu pandemic had caused a downturn in foreign tourist arrivals to certain countries with more severe cases. For example, a study by Rassy and Smith (2013) revealed tourist arrivals in Mexico down by almost 1 million. Another study by Page et al. (2012) demonstrated a fall of about 1,6 million people in the United Kingdom.

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Unlike with swine flu, Covid-19 cases in Indonesia were widespread, reaching around 743,000 cases, while worldwide cases reached 83.7 million by the end of 2020. Given the existing conditions, severe measures such as lockdown and restrictions on international travel are considered necessary to control the spread of Covid-19. As in other countries, the government of Indonesia has also gradually limited international travel. Initial restrictions were only applied to Chinese citizens and foreigners who had lived in China., but this was expanded to include all countries in the period from April to September 2020. The restriction policy immediately impacted the tourism sector with a drastic fall in foreign tourist arrivals followed by a period of stagnation after the relaxation of travel restrictions on September 28th, 2020. This trend reveals that security remains a significant consideration so that relaxation could not attract foreign tourists while the spread of Covid-19 was still out of control. The decline in foreign tourist arrivals in 2020 occurred not just in Indonesia, but throughout the world.

The Impact of Natural Disasters

Table 2 shows the negative impact of natural disasters (volcanic eruptions and earthquakes) on foreign tourist arrivals. The earthquake had a significant effect on foreign tourist arrivals, reducing them by 28.2% in the year the disaster occurred and 39.4% in the next. Meanwhile, volcanic eruptions lowered foreign tourist arrivals by 10.2% in the year the disaster occurred and had no significant effect in the following year. These findings indicate that the impact of earthquakes was more persistent than volcanic eruptions. Tourists could respond differently to various types of natural disaster events according to their characteristics. For example, Wu and Hayashi (2014) found that natural disasters in the form of earthquakes reduced visitation to Japan while extreme weather did not, because the character of extreme weather was relatively predictable.

The earthquake caused a more significant and longer decrease in international tourist numbers because it led to much greater physical damage. The earthquake disasters in West Sumatra in 2009 and Lombok in 2018, which were components of the earthquake variable, caused damage to tourist sites and infrastructure. Tourism was disrupted due to physical damage causing tourist sites to be inaccessible or hard to reach because of infrastructure devastation and such disruptions, along with a deteriorating destination image, led to a decline in foreign tourist arrivals. Tourist perception of earthquake risk tends to be higher than with other disasters because earthquake events cannot be predicted. Earthquakes occur suddenly and aftershocks pose a further potential threat. Severe physical damage made people reluctant to visit, so the following year's decline was even more significant. In addition, the decline in foreign tourist visits in the year of the disaster was lower due to the arrival of foreign nationals for the humanitarian mission, which statistically remained recorded as foreign tourists.The results of this study are in line with several previous studies that demonstrate how earthquakes negatively affect foreign tourist arrivals. Huang and Min (2002) found that the September 1999 Taiwan earthquake led to a drop in visitor numbers between 1999 and 2000. The empirical findings of Min et al. (2020) revealed that the April 2015 earthquake in Nepal made foreign tourists arrive for business, and travel for official purposes did not fully recover until 2018.

Steps must be taken after an earthquake to repair damage to both tourist infrastructure and destination image. The first step that needs to be taken during the

recovery period is to provide timely information to make foreign tourists and prospective tourists feel safe (Durocher, 1994). Nevertheless, it can take quite a long time for visitor numbers to reach pre-disaster levels. In the case of the 2009 West Sumatra earthquake, even though the physical damage had been fully repaired, the public image did not immediately improve. This image can be shaped by media coverage such that the accuracy of its reporting may influence foreign tourists' decisions. Media coverage intended to attract attention to the disaster (Wu & Hayashi, 2014) consequently further worsened the image of the destination. Several countries hit by earthquakes have implemented strategies to improve the destination image. Taiwan, for example, invited 400 representatives of foreign media outlets to visit areas affected by the 1999 earthquake to provide an overview of current developments and reduce negative news (Min, 2008). Meanwhile, Turkey placed advertisements with the messages "Safety" and "Turkey, The Center of World History" on US television after the earthquake in 1999 (Huang & Min, 2002).

In contrast to earthquakes, our estimates found that volcanic eruptions only reduce foreign tourist arrivals in the year of the disaster. This empirical finding is in line with Jónsdóttir's (2011) research, which explains that declines in visits to Iceland after the eruption of Mount Eyjafjallajökull lasted a relatively short time. Purwa and Atmanegara (2020), who specifically analyzed the flow of international tourists during the 2015 Mount Rinjani and 2017 Mount Agung eruptions, also revealed that a decline in visits only lasted a few months after the disaster.

The volcanic eruption only impacted mountainous areas, so it did not interfere with tourist activities in major destinations relatively far away. These eruptions only caused physical damage to the settlements around the mountain and did not destroy tourist sites or infrastructure. However, because the volcanic ash eruption threatened flight safety, airports were closed, disrupting mobility and resulting in the cancellation of international flights, and it is these closures and cancellations that led to the short-term fall in visitor numbers. The eruption could also tarnish the image of the destination from a standpoint of security, leading to a tourist's decision to postpone or cancel a trip, although this image deterioration only lasted for a relatively short period. The monitorable and predictable character of volcanic eruptions allows a faster recovery process. In Indonesia, PVMBG regularly monitors and reports on the status of mountains, estimated eruptions, estimates of affected areas, and recommendations as to which human activities may or may not be carried out within a certain radius, meaning that tourists have sufficient information to take part safely in tourist activities.

The Impact of Terrorism

Table 2 reveals that terrorism had no significant statistical effect on international tourist flow, either in the year of attack or the following year. This finding might reflect that the terrorist attacks in this study did not occur in the tourist destination. In addition, the scale of the attack was relatively small, and the target mainly law enforcement officers rather than foreigners. Under these conditions, terrorism events did not seem to frighten off most foreign tourists. For example, the 2016 terrorist attack in Jakarta, astonishingly, attracted locals and foreigners to the crime scene to take selfies or conduct business activities (Azani, 2016). Terrorist attacks in the period from 2008 to 2020 were different from previous terrorist attacks, such as the Bali Bombings in 2002 and 2005, which

targeted tourist sites and caused many casualties among foreign tourists. Our finding indicates that Indonesian tourism was resilient enough to recover after a terrorist attack.

Several Indonesian government policies are considered capable of reducing the capabilities of terrorists and their networks (US Bureau of Counterterrorism, 2017). Serious efforts to eradicate terrorism have been continuously conducted since 2002 by improving the legal and institutional framework. Legal framework improvement aimed to provide the legal basis for preventing the financing and commission of terrorist crimes through powers of surveillance and arrest. Meanwhile, the institutional framework was improved through the establishment of an elite police counterterrorism force (Densus 88) in 2003 and the National Counterterrorism Agency (BNPT) in 2010. While Densus 88 focuses on law enforcement, BNPT focuses on deradicalization programs.

The results of this study are in line with empirical findings by Liu and Pratt (2017), who stated that international tourism is generally resilient to terrorism because terrorism only has relatively small-scale, short-term effects. A qualitative study by Wolff and Larsen (2014) further explained that tourist perceptions of risk and concerns about Norwegian destinations were relatively low after the bombings in July 2011. However, other studies have demonstrated the opposite. Llorca-Vivero (2008), analyzing foreign tourist flow from the G-7 countries to 134 destinations in the period from 2001 to 2003, revealed that terrorism had a significant negative effect. Likewise, a study by Yaya (2009), which used data from 1985–2006, found that terrorism had led to a decline in foreign tourist arrivals to Turkey.

The Impact of Control Variable

Other than the variable of interest, we have also presented a discussion on the results of control variables. The number of foreign tourist arrivals in the previous year ($TA_{ijt-1)}$ positively affected visitation in the current year. This finding aligns with studies by Habibi (2017) and Muryani et al. (2020). Foreign tourists have a positive impression of Indonesian tourism, leading to word-of-mouth recommendations and increasing visitation in the following year.

The government's efforts to increase the attractiveness of destinations through direct flights (DirectFlight) and visa exemption policies have proven successful in increasing foreign tourist arrivals (VisaFree). Direct flight significantly increases foreign tourist arrivals by an average of 73.9% through the entry points of Lombok since 2013 and Manado since 2016. Meanwhile, the visa exemption policy increased foreign tourist visitation by up to 18.2%. The impact of the visa exemption policy was less than that of direct flights. Previously, Yudhistira et al. (2020), using monthly panel data, found that visa-free facilities only increased visits by 5%. However, this finding indicates that these policies are an essential component of tourism. Direct flights provide simplified transportation, while visa-free facilities simplify immigration requirements. Both can strengthen the competitiveness of destinations from the aspect of accessibility, as suggested by March (2004).

Meanwhile, political stability in the tourist origin (POLITIC), had a significant negative impact. Continuous demonstrations in Thailand (2014) and Hong Kong (2019) have disrupted political stability. The result confirmed the initial hypothesis that political instability causes foreign people to focus more on domestic problems and be less

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interested in going abroad. Our finding confirms that visitor numbers decline in the presence of crises in the destination or origin countries.

The economic control variable findings showed that only GDP per capita (GDP) had a significant effect, while the exchange rate (ExcRate) and jet fuel prices (JetFuel) did not. GDP had a significant positive effect, so increasing the GDP in tourist countries of origin would further increase visitation. This finding is in line with Habibi (2017), Nahar et al., (2019) and Muryani et al., (2020). An increase in GDP means that purchasing power has increased, thus encouraging growth in tourism demand. The exchange rate (ExcRate) was not significant, and the decision to travel to Indonesia was not influenced by the fluctuation of the value of the rupiah against the US dollar. Our results confirmed findings by Nugroho et al. (2014) and Azhar et al. (2018), who concluded that exchange rates had no impact on foreign tourist visits either to Bali specifically or Indonesia as a whole. Jet fuel price (JetFuel) was found not to have affected foreign tourist arrivals. This finding contradicted other studies such as Xu et al. (2018) and Hopken et al. (2017). Our different findings could be explained because most tourists visiting Indonesia came from neighboring countries, such as ASEAN and Australia, so flights were still classified as short-haul. Day and Chin (2018) noted that the increase in jet fuel prices has more impact on long-haul flights than short-haul flights. Ringbeck et al. (2009) further explained that fuel accounts for up to 30% of the cost of a long-haul flight and only around 17% for short-haul flights. In addition, the existence of a hedging scheme is also able to mitigate airlines' risk from oil price fluctuations.

Country-Origin Result

Table 3 shows that the effect of various disasters on foreign tourist arrivals is not the same across tourist origin countries. While the Covid-19 pandemic reduced visitation from all countries, the swine flu pandemic only led to decreased visitation from the Philippines, China, and India. Natural disasters in the form of earthquakes negatively affect foreign tourist arrivals from 13 countries, namely Malaysia, Singapore, Philippines, Thailand, China, Japan, South Korea, Taiwan, the Netherlands, Germany, France, Russia, and the USA. The volcanic eruption only led to a downturn in visits from two countries, namely Singapore in the year of the eruption and Taiwan in both the year of the eruption and the year following. In line with the base result, terrorism did not significantly affect travel from most countries, only reducing numbers of visitors from Japan, Taiwan, and the USA.

Table 3 Effect of Disaster on Foreign Tourist Arrival (Country-Origin Result)

Negara	Pandemi		Natural Disaster				Terroisme		R^2
	Swine flu	Covid-19	Earthquake	Earthquake (t-1)	Eruption	Eruption (t-1)	Terror	Terror (t-1)	
Malaysia	0.0549	-1.687***	-0.164	-0.906**	-0.144	0.133***	0.0847	0.142**	0.836
Singapore	-0.152	-1.954***	0.279	-1.452*	-0.177*	0.133**	0.0792*	0.117*	0.758
Philippines	-0.384**	-1.947***	-0.603***	-0.145	-0.103	0.179	-0.0741	0.107*	0.663
Thailand	-0.0325	-2.038***	-0.345	-0.744**	0.0107	0.0232	0.113	-0.0292	0.706
China	-0.405**	-1.999***	-0.213*	-0.305	0.334	0.0347	-0.134	0.209**	0.867
Hongkong	0.377	-5.590***	-1.028	0.178	-0.212	-0.158	0.112	-0.0173	0.806
Japan	0.0757	-1.751***	-0.191	-0.341***	0.0543	0.00895	-0.116**	-0.0549	0.832

South Korea	0.0310	-1.497***	-0.804***	-0.729	0.0661	-0.0374	0.0800	0.0193	0.621
Taiwan	0.217	-2.457***	-0.705	-0.537*	-0.911**	-0.239**	-0.160	-0.180**	0.724
India	-0.226*	-1.979***	-0.168	-0.285	0.298**	0.0930	-0.0780	0.0729	0.798
Australia	0.326	-1.579***	-0.563	0.556	-0.344	-0.0806	-0.0715	-0.0699	0.576
New Zealand	-0.183	-1.966***	-0.143	0.150	-0.217	-0.100	-0.194	-0.0517	0.665
Netherlands	-0.0613	-2.428***	-0.00329	-0.343**	-0.0968	0.0354	0.291	0.423**	0.570
UK	0.129	-1.772***	-0.112	-0.176	0.0751	0.0868	-0.0917	-0.0346	0.778
Germany	0.0867	-1.740***	-0.276	-0.537*	0.0621	-0.0316	-0.0448	0.0105	0.797
France	0.132	-1.625***	-0.291*	-0.307**	0.0987	-0.0662	0.0492	0.0200	0.814
Russia	-0.0400	-1.497***	0.0880	-0.419***	-0.107	0.106	-0.0312	0.173	0.455
USA	0.0813	-1.893***	0.0698	-0.572***	-0.0467	0.0862	-0.122**	0.0139	0.844
Canada	0.0708	-1.273***	0.359	-0.0833	0.0270	0.0279	-0.0669	0.0121	0.605

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Our findings revealed that risk-averse or risk-taking behavior varied according to a tourist's nationality. Tourists from Taiwan were the most sensitive, with desire to visit lowered by all types of disasters except swine flu. The sensitivity of Taiwanese tourists can be explained since the country also has experience being hit by geological disasters like earthquake. The study of Shahrabani et al. (2019) found that foreign tourists from certain countries would be less interested in visiting destinations that experienced similar problems.Meanwhile, tourists from Australia, New Zealand, and Canada are the least sensitive groups, decreasing visitation only because of the Covid-19 pandemic.

CONCLUSION

The tourist sector, especially where dependent on international tourist flows, is vulnerable to external factors such as disasters. This study has demonstrated that various disasters, i.e., epidemics, natural disasters, and terrorism, impacted foreign tourist arrival differently. The swine flu had no significant effect, because its spread could be controlled in Indonesia. Meanwhile, the Covid-19 pandemic, whose rate of spread is out of control, has disrupted the tourist sector, so that foreign tourist arrivals have dropped dramatically. Natural disasters like earthquakes significantly reduced foreign tourist arrival in the year of the disaster as well as the following year because of the broader impact of physical damage. Volcano eruptions only had a significant effect on reducing foreign tourist visits in the same year. Terrorism had no significant effect on foreign tourist visits because attacks took place at non-tourist destinations and were relatively small in scale. We revealed that the behavior of tourists in dealing with disaster events varied by country of origin. Tourists from Taiwan are sensitive groups, while tourists from Australia, New Zealand, and Canada are resilient to disasters.

Our empirical findings have confirmed that tourism is vulnerable to disaster events. The findings imply that tourism development can not be achieved without understanding how disasters shock the tourist industry. Therefore, better disaster management is a prerequisite for the better management of tourism.

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