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The International Tourism Performance Amidst Several Intervention Events: More than 20 Years of Multi Input Intervention Analysis in Bali, Jakarta, and Kepulauan Riau Provinces

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Abstract

As one of the priority sectors in economic development of Indonesia, tourism is expected to be the main key in accelerating economic and social growth, hence reducing poverty. The tourism performance, especially international tourism market, is highly prone to intervention events that can reduce the number of inbound tourists and produce a negative impact on economic development of the destination country. Therefore, anticipating and mitigating various intervention events is necessary to maintain the performance of the tourism sector in Indonesia. This study investigates the magnitude and patterns of impact of several intervention events on the number of international visitor arrivals via the three main ports of entry of Indonesia, i.e. Soekarno-Hatta Airport, Ngurah Rai Airport, and Batam Port. The multi input intervention models were constructed by covering intervention events, i.e. terrorism, disease pandemic, global financial crisis, natural disaster, and government policy, occurring in a relatively long time span, more than two decades, from January 1999 to August 2020. The results show that an intervention event does not always have a significant impact on the number of international visitor arrivals at the three main ports of entry. Generally, all intervention events can lead to a decrease in the number of international visitor arrivals but with different magnitude and pattern, with the biggest and longest impact is caused by COVID-19 pandemic. The direct or non-delayed pattern of impact only appears for terrorism and natural disaster that affect the number of international visitor arrivals via Ngurah Rai Airport.

Keywords: tourism; international visitor arrivals; intervention model; natural disaster; terrorism; COVID-19

JEL classifications: C22; F62; L83; Z32

1. Introduction

Having an abundance of natural and cultural wealth, Indonesia has made tourism one of the priority sectors in economic development. Through job creation, infrastructure development, and foreign exchange earnings, tourism is expected to be the main key to accelerating economic growth (Statistics Indonesia 2020b). The tourism sector also plays an important role in promoting the economic image of a country globally (Dupeyras & MacCallum 2013). By using government policy instruments, the development of the tourism sector can generate sustainable economic and social growth, hence reducing poverty (Khan et al. 2020). Various empirical studies have confirmed that the development of the tourism sector can create multiplier effects for other sectors through backward and forward linkages (Lin, Yang & Li 2018).

In addition to the domestic tourism market, the Indonesian government is also concerned with improving the international tourism market. To accelerate regional development and economic growth, Indonesia has developed several Special Economic Zones (KEK) that have geo-economic and geo-strategic advantages of in term of industry, export, import, and tourism (The National

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Council for Special Economic Zones of Republic of Indonesia 2020). There are five Special Economic Zones already operating in tourism, i.e. Sei Mangkei, Tanjung Kalayang, Tanjung Lesung, Mandalika, and Morotai. Based on *The Travel and Tourism Competitiveness Report* (World Economic Forum 2015,2017,2019), *The Travel and Tourism Competitiveness Index of Indonesia* has shown a positive trend, starting from 4.04 (ranked 50th) in 2015, 4.2 (ranked 42nd) in 2017, and 4.3 (ranked 40th) in 2019.

The arrival of international visitors or inbound tourists is a main indicator of international tourism market. The increasing number of arrivals can lead to higher tourist expenditure that contributes to economic development. According to *The 2017 Tourism Satellite Account of Indonesia*, the contribution of inbound tourist expenditure to the Gross Domestic Product is about 1.34 percent, nearly similar to the contribution of domestic tourists, namely 1.64 percent (Statistics Indonesia 2020a). The tourism performance, especially international tourism market, is highly influenced and highly prone to intervention events, such as natural disaster, man-made disaster, financial crisis, terrorism and disease pandemic (Novelli et al. 2018). These intervention events can reduce the number of inbound tourists and produce a negative impact on economic development of the destination country. Therefore, anticipating and mitigating various intervention events is necessary to maintain the performance of the tourism sector and its contribution to economic development in Indonesia.

This study contributes to supporting the anticipation and mitigation of intervention events by investigating the impact, i.e. magnitude and pattern, of several intervention events on international visitor arrivals. Compared to the several previous studies that utilized the intervention model, this study included more intervention events consisting of terrorism, disease pandemic, global financial crisis, natural disaster, and government policy occurring in the three ports of entry of Indonesia, i.e. Soekarno-Hatta Airport (Jakarta), Ngurah Rai Airport (Bali), and Batam Port (Kepulauan Riau) on a relatively long period of time, namely more than two decades from January 1999 to August 2020. The use of intervention events at these three different ports of entry aims to determine whether a particular intervention event has different impact behaviors in different areas.

The remaining layout of this study is as follows: Section 2 discusses the overview of the impact of intervention events on several sectors, including tourism, from previous studies; Section 3 provides a brief overview of multi input intervention models and the sources of the data used in this study; Section 4 reports the visual inspection of the impact of intervention events on international visitor arrivals and the results of an empirical analysis of the multi input intervention models; Section 5 presents the conclusion, academic and policy implication of this study, and the indication for future studies.

2. Literature Review

In time series data, an event known when occurring is said to be an intervention event supposing it causes the observed value at a certain time to be inconsistent compared to other observations at other time when the intervention does not occur (Wei 2006). Intervention analysis has been widely used to investigate the impact of intervention events on certain time series data. The previous studies by Min (2008), Atmanegara, Suhartono & Atok (2019), Lee, Suhartono & Sanugi (2010), and Mangindaan & Krityakierne (2018) employed an intervention analysis to measure the impact of several intervention events on international tourist arrivals to Taiwan, Indonesia, and Bali. The intervention events used in these studies include the financial crisis in ASIA in July 1997, Taiwan's earthquake in September 1999, the 9/11 terrorist attack in September 2001, Bali Bombing 1 in October 2002, SARS outbreak in 2003, Bali Bombing 2 in October 2005, the closure of gambling locations in Batam in June 2005, promotion of Indonesian sharia tourism in October 2013, Sarinah bomb-

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ing in January 2015, the eruption of Mount Raung in August 2015, and the eruption of Mount Rinjani in November 2015. Another study by Ismail et al. (2009) used Bali Bombing 1 as an intervention event to the occupancy rate of five-star hotel rooms in Bali.

The summary of these previous studies that focused on international visitor arrivals related to the data used, number of observations, and intervention events is presented in Table 1. All of these studies only employed one series data on international visitor arrivals, except the study by Atmanegara, Suhartono & Atok (2019) that used international visitor arrivals to Indonesia from Bahrain and Singapore. The longest period of series data (number of observations) is used by Min (2008), i.e. from January 1979 to August 2006 (336 observations). The number of intervention events incorporated in these studies are only two intervention events, except the study by Lee, Suhartono & Sanugi (2010) that used three intervention events.

Generally, the results of these previous studies show that the intervention events have a negative impact on tourism-related indicators, except the sharia tourism promotion that shows a positive impact. In case of the patterns of impact, different types of intervention events tend to produce different patterns of impact. Observed by Min (2008), SARS outbreak and Taiwan earthquake had a direct impact on international visitor arrivals at the time of these intervention events. The impact was mostly experienced one month following the events and diminished gradually. The study by Mangindaan & Krityakierne (2018) shows that SARS outbreak and natural disaster, i.e. the eruption of Mount Raung in August 2015 and the eruption of Mount Rinjani in November 2015, also gave direct impact on international visitor arrivals. The only difference is that the impact did not appear afterwards.

Interestingly, the studies conducted by Atmanegara, Suhartono & Atok (2019), Lee, Suhartono & Sanugi (2010), and Mangindaan & Krityakierne (2018) show different patterns of impact of terrorism attack, i.e. Bali Bombing 1 and 2, on international visitor arrivals. Since these two terrorism attacks occurred in Bali, they had direct and gradually diminished impact on international visitor arrivals to Bali (Mangindaan & Krityakierne 2018). Similar pattern of impact is also shown by the 9/11 Attack. Meanwhile, observed from other studies by Atmanegara, Suhartono & Atok (2019) and Lee, Suhartono & Sanugi (2010) that focused on international visitor arrivals to Indonesia and via Soekarno-Hatta Airport, respectively, the impact were delayed and only experienced several months afterwards.

Referring to Lee, Suhartono & Sanugi (2010), Asian Financial Crisis in July 1997 had an impact on the delay in international visitor arrivals via Soekarno-Hatta Airport, i.e. only in May 1998 or 10 month afterwards. The government policy issuing the closure of gambling location in Batam in June 2005 and sharia tourism promotion in October 2013, as studied by Atmanegara, Suhartono & Atok (2019), showed different patterns of impact, where the former had the impact lasted for 6 months while the latter had a delayed impact that appeared three months following the promotion.

The intervention analysis is also used in others sector. In transportation sector, Suhartono, Lee & Rezeki (2017) used the intervention analysis to evaluate the impact of Lapindo mud disaster to the volume of vehicles on the Waru-Gempol highway. In addition, Wiradinata et al. (2017) measured the impact of forest fires as well as illegal burning and peat-land in Riau Province on the number of domestic airline passenger. The intervention analysis was also used by Novianti & Suhartono (2009) to measure the impact of rising fuel price, change in base year, financial crisis in Asia, the independence of East Timor, and tsunami disaster on macroeconomic data, i.e. the Consumer Price Index (CPI) of Indonesia. Meanwhile, the impact of hurricanes, floods, cyclones, earthquakes and forest fires on Australian stock prices was evaluated by Worthington & Valadkhani (2004).

Table 1. Summary of Previous Studies Employing the Intervention Analysis in Tourism Sector

Author/s	Data (Number of Observations)	Intervention
Min (2008)	International visitor arrivals to Taiwan from January 1979 to August 2006 (336 obs.)	- Earthquake, September 1999 - SARS outbreak, April 2003
Atmanegara et al. (2019)	International visitor arrivals from Bahrain to Indonesia from January 2001- December 2017 (204 obs.) International visitor arrivals from Singapore to Indonesia from January 2001- December 2017 (204 obs.)	- Bali Bombing 2, October 2005 - Sarinah Bombing, January 2015 - The closure of gambling sites, June 2005 - Sharia tourism promotion, October 2013
Lee, Suhartono & Sanugi (2010)	International visitor arrivals via Soekarno-Hatta Airport (Jakarta) from January 1989 to December 2009 (252 obs.)	- Asian financial crisis, July 1997 - Bali Bombing 1, October 2002 - Bali Bombing 2, October 2005
Mangindaan & Krityakierne (2018)	International visitor arrivals to Bali from January 2000 to August 2017 (212 obs.)	- The 9/11 Attacks, September 2001 - Bali Bombing 1, October 2002 - SARS outbreak, April 2003 - Bali Bombing 2, October 2005 - The eruption of Mount Raung, August 2015 - The eruption of Mount Rinjani, November 2015

Source: summarized from relevant studies

According to the aforementioned results of previous studies, especially those focusing on the tourism sector, there are research gaps that will be filled in this study, i.e. performing an intervention analysis on a relatively long period of time by including more intervention events and investigating the impacts, i.e. magnitude and pattern, of these intervention events on international visitor arrivals in the three main ports of entry of Indonesia, i.e. Soekarno-Hatta Airport (Jakarta), Ngurah Rai Airport (Bali) and Batam Port (Kepulauan Riau) since, based on previous studies, similar intervention events do not always produce similar patterns of impact in different locations or ports of entry.

3. Method

This section consists of two parts. The first part provides the theoretical model based on uni-variate time series analysis, i.e. multi input intervention analysis while the second part describes the data used, period of study, source, a list of intervention events incorporated in the model and statistical software used to produce graphs and estimate multi input intervention analysis.

3.1. Theoretical Model

According to the Organisation for Economic Co-operation and Development or OECD (2012), there are four approaches that can be used in evaluating the tourism sector, i.e. The Tourism Satellite Account (TSA), Input-Output Models, Computable General Equilibrium (CGE) model, and econometric method, especially the intervention model. The latter approach, the intervention model, is the most widely employed method based on time series data in determining the levels of tourism demand (Min 2008) that first originally developed by Box & Tiao (1975).

As an extension of the Autoregressive Integrated Moving Average (ARIMA) model, the first procedure to develop an intervention model is to estimate the pre-intervention ARIMA model based on a subset of observations before the first intervention, $t = 1, 2, \ldots, T_1 - 1$ using the four steps illustrated by Box

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& Jenkins (1976), i.e. model identification, model estimation, residual diagnostic checking, and forecasting. The seasonal multiplicative ARIMA model, or commonly abbreviated as ARIMA$(\mathrm{p,d,q})(\mathrm{P,D,Q})^{\mathrm{S}}$, is generally written as follows (Wei 2006; Cryer & Chan 2008):

$$\phi_{\mathrm{p}}(\mathrm{B})\Phi_{\mathrm{P}}(\mathrm{B}^{\mathrm{s}})(1-\mathrm{B})^{\mathrm{d}}(1-\mathrm{B}^{\mathrm{s}})^{\mathrm{D}}\mathrm{Y}_{\mathrm{t}} = \theta_{\mathrm{q}}(\mathrm{B})\Theta_{\mathrm{Q}}(\mathrm{B}^{\mathrm{s}})\mathrm{a}_{\mathrm{t}} \quad (1)$$

where $\mathrm{Y_t}$ is the response variable at time t with $(1-\mathrm{B})^{\mathrm{d}}$ is the regular differentiating with order d and $(1-\mathrm{B}^{\mathrm{s}})^{\mathrm{D}}$ is the seasonal differentiating S with order D used if $\mathrm{Y_t}$ contains trend and seasonal pattern, with B is a backshift operator. $\phi_{\mathrm{p}}(\mathrm{B}) = (1-\phi_1\mathrm{B}-\phi_2\mathrm{B}^2-\cdots-\phi_{\mathrm{p}}\mathrm{B}^{\mathrm{p}})$ is an AR component with order p and $\Phi_{\mathrm{P}}(\mathrm{B}^{\mathrm{s}}) = (1-\phi_1\mathrm{B}^{\mathrm{S}}-\phi_2\mathrm{B}^{2\mathrm{S}}-\cdots-\phi_{\mathrm{P}}\mathrm{B}^{\mathrm{PS}})$ is an AR component of the seasonal period S with order P. $\theta_{\mathrm{q}}(\mathrm{B}) = (1-\theta_1\mathrm{B}-\theta_2\mathrm{B}^2-\cdots-\theta_{\mathrm{q}}\mathrm{B}^{\mathrm{q}})$ is a MA component with order q and $\Theta_{\mathrm{Q}}(\mathrm{B}^{\mathrm{s}}) = (1-\Theta_1\mathrm{B}^{\mathrm{S}}-\Theta_2\mathrm{B}^{2\mathrm{S}}-\cdots-\Theta_{\mathrm{Q}}\mathrm{B}^{\mathrm{QS}})$ is a MA component of the seasonal period S with order Q. $\mathrm{a_t}$ is a white noise process with $\mathrm{E}(\mathrm{a_t}) = 0$, $\mathrm{Var}(\mathrm{a_t}) = \sigma_\alpha^2$ and $\mathrm{Cov}(\mathrm{a_t}, \mathrm{a_{t+k}}) = 0, \mathrm{k} \neq 0$.

To calculate the residual or response value, $\mathrm{Y_t^*} = \mathrm{Y_t} - \hat{\mathrm{Y}}_{\mathrm{t}}$, for $\mathrm{t} = \mathrm{T_1}, \mathrm{T_1}+1, \mathrm{T_1}+2, \ldots, \mathrm{T_2}-1$ with $\hat{\mathrm{Y}}_{\mathrm{t}}$ is forecast value obtained from ARIMA procedures. The plot of this response value is used to determine the coefficients of the intervention model, i.e. b or the delay time, s or the time needed for an effect of the intervention to be stable, and r or the pattern of the intervention effect. The various patterns of response values with corresponding values of b, s, and r are described in Box & Tiao (1975), Montgomery & Weatherby (1980), and Lee, Suhartono & Sanugi (2010). Furthermore, the first intervention model is estimated with the following formula (Wei 2006):

$$\mathrm{Y_t} = \frac{\omega_{\mathrm{s}}(\mathrm{B})}{\delta_{\mathrm{r}}(\mathrm{B})}\mathrm{B}^{\mathrm{b}}\mathrm{X_t} + \frac{\theta_{\mathrm{q}}(\mathrm{B})\Theta_{\mathrm{Q}}(\mathrm{B}^{\mathrm{s}})}{\phi_{\mathrm{p}}(\mathrm{B})\Phi_{\mathrm{P}}(\mathrm{B}^{\mathrm{s}})(1-\mathrm{B})^{\mathrm{d}}(1-\mathrm{B}^{\mathrm{s}})^{\mathrm{D}}}\mathrm{a_t} \quad (2)$$

where $\mathrm{X_t}$ is a binary indicator variable that shows the existence of an intervention at time t, $\omega_{\mathrm{s}}(\mathrm{B}) = \omega_0-\omega_1\mathrm{B}-\omega_2\mathrm{B}^2-\cdots-\omega_{\mathrm{s}}\mathrm{B}^{\mathrm{s}}$, and $\delta_{\mathrm{r}}(\mathrm{B}) = 1-\delta_1\mathrm{B}-\delta_2\mathrm{B}^2-\cdots-\delta_{\mathrm{r}}\mathrm{B}^{\mathrm{r}}$.

There are two common types of intervention $\mathrm{X_t}$, namely the step $(\mathrm{S_t})$ and pulse $(\mathrm{P_t})$ functions. A step function is a type of intervention occurring in a long term and written as:

$$\mathrm{S_t} = \begin{cases} 0, & \mathrm{t} < \mathrm{T} \\ 1, & \mathrm{t} \geq \mathrm{T} \end{cases}$$

where the intervention starts at $\mathrm{t} = \mathrm{T}$. An intervention that occurs only at a certain time (T) is called a pulse intervention and is written as:

$$\mathrm{P_t} = \begin{cases} 0, & \mathrm{t} \neq \mathrm{T} \\ 1, & \mathrm{t} = \mathrm{T} \end{cases}$$

The procedure of forecasting, calculating the residual or response value, determining the values of b, s, and r then estimating the intervention model are the repeated subsequent intervention events. Considering that there are k intervention events, the multi input intervention model can be written as:

$$\mathrm{Y_t} = \sum_{\mathrm{i}=1}^{\mathrm{k}} \frac{\omega_{\mathrm{s_i}}(\mathrm{B})}{\delta_{\mathrm{r_i}}(\mathrm{B})}\mathrm{B}^{\mathrm{b_i}}\mathrm{X_{i,t}} + \frac{\theta_{\mathrm{q}}(\mathrm{B})\Theta_{\mathrm{Q}}(\mathrm{B}^{\mathrm{s}})}{\phi_{\mathrm{p}}(\mathrm{B})\Phi_{\mathrm{P}}(\mathrm{B}^{\mathrm{s}})(1-\mathrm{B})^{\mathrm{d}}(1-\mathrm{B}^{\mathrm{s}})^{\mathrm{D}}}\mathrm{a_t} \quad (3)$$

The detailed explanations of model development for the intervention model can be found in Wei (2006), Novianti & Suhartono (2009), and Lee, Suhartono & Sanugi (2010).

Under the scheme of intervention analysis, by using the values of b, s, and r, the magnitude and pattern of the impact of the intervention event can be modeled. In other words, the information of when the impact is experienced after the intervention event, how long the impact lasts, and the magnitude of that impact becomes the standard output of the intervention analysis. It allows the intervention model to capture a more dynamic pattern of impact than using dummy variable schemes in regression or time series analysis.

3.2. Data and Source

This study utilized monthly data of the number of international visitor arrivals to Indonesia from January 1999 until August 2020 via three main ports of entry, i.e. Ngurah Rai Airport, Soekarno-Hatta Airport, and Batam Port, obtained from the Statistics Indonesia (BPS) via Statistics Service Information System (SILASTIK) at silastik.bps.go.id. Over the last 20 years, various interventions have occured and have been thought to affect foreign tourist arrivals. Ngurah Rai Airport, Soekarno-Hatta Airport, and Batam Port were chosen because they are the three main ports of entry for international visitor arrivals to Indonesia. About 66 percent of international visitor arrivals enter Indonesia through these ports of entry. Ngurah Rai Airport is the biggest port of entry. In 2019, it reached more than 6 million visitors (39 percent). The second one is Soekarno-Hatta Airport (15 percent), followed by Batam Port (12 percent) (Statistics Indonesia 2020b). In this study, $\mathrm{Y}_{1,\mathrm{t}}$, $\mathrm{Y}_{2,\mathrm{t}}$, and $\mathrm{Y}_{3,\mathrm{t}}$ denote the number of international visitor arrivals via Ngurah Rai Airport, Soekarno-Hatta Airport, and Batam Port at time t, respectively.

Figure 1 shows each time series plot of monthly international visitor arrivals via three main ports of entry. Ngurah Rai Airport is the main entrance with the most foreign tourists visits, followed by Soekarno-Hatta Airport and Batam Port. Apart from the most visits, Ngurah Rai Airport also shows the largest increase in visits. The number of visits to each port fluctuates each year. Usually, the number of visits during the holiday season is the highest number of visits each year. July, August, and December are the months with the most visits. Increasing the number of foreign tourists continues to be pursued by making improvements and promoting tourism. Unfortunately, the decline in the number of foreign tourists is sometimes inevitable. This decrease can occur as a result of an event called an intervention. Interventions can take the form of terrorism, disease pandemic, global financial crisis, natural disaster, and government policy.

There are eleven interventions used in this study that can influence the number of international visitor arrivals to Indonesia via three main ports of entry, namely the 9/11 Attack, Bali Bombing 1, SARS outbreak, the closure of gambling sites, Bali Bombing 2, Global Financial Crisis, Sarinah Bombing, the Eruption of Mount Raung, the Eruption of Mount Rinjani, the Eruption of Mount Agung, and the corona virus (COVID-19) pendemic. All of the intervention events are pulse functions, except the last intervention event, i.e. the COVID-19 pandemic, that is step function. The intervention effects analyzed at each port of entry and when they occur are presented in Table 2. Regarding COVID-19 pandemic, January 2020 is used as the starting point rather than March 2020 since World Health Organization (WHO) has declared this outbreak as a Public Health Emergency of International Concern (Cucinotta & Vanelli 2020) in January 2020, restricting the mobility of people globally.

Not all interventions were used at all three ports of entry. The intervention model at Ngurah Rai Airport was modeled with ten interventions. All interventions were modeled except for The Closure of Gambling Sites. This event was not used in this modeling because it only occurred in Batam and generally had no impact on foreign tourists visits through Ngurah Rai Airport. The intervention model at Soekarno-Hatta Airport employed seven interventions. The Closure of Gambling Sites in Batam and the three mount eruptions were not incorporated in the model. The intervention model at Batam Port employed eight interventions. The three mount eruptions were not used in this modeling. All the graphs in this study were produced using MINITAB 18 and the multi input intervention analysis was carried out using the statistical software SAS 9.

4. Result

In this section, the impact of intervention events will be observed visually from time series plots or

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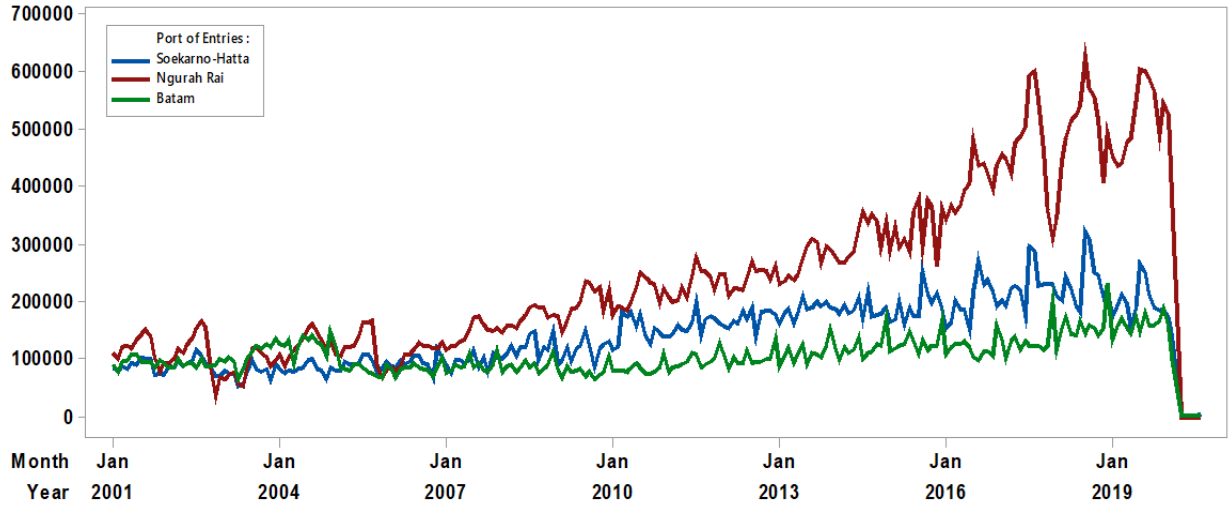

Figure 1. Time Series Plot of Monthly International Visitor Arrivals (in Thousands)
Source: BPS, calculated by authors

Table 2. Summary of Previous Studies Employing the Intervention Analysis in Tourism Sector

No.	Interventions	Time	Reference	Ngurah Rai Airport	Soekarno -Hatta Airport	Batam
1	The 9/11 Attack	Sep-01	Mangindaan & Krityakierne (2018)	$T_{1,1}$	$T_{2,1}$	$T_{3,1}$
2	Bali Bombing 1	Oct-02	Mangindaan & Krityakierne (2018), Ismail et al. (2009), Lee, Suhartono & Sanugi (2010)	$T_{1,2}$	$T_{2,2}$	$T_{3,2}$
3	SARS outbreak	Feb-03	Mangindaan & Krityakierne (2018), Min (2008)	$T_{1,3}$	$T_{2,3}$	$T_{3,3}$
4	The Closure of Gambling Sites	Jun-05	Atmanegara, Suhartono & Atok (2019)	-	-	$T_{3,4}$
5	Bali Bombing 2	Oct-05	Mangindaan & Krityakierne (2018), Lee, Suhartono & Sanugi (2010), Atmanegara, Suhartono & Atok (2019)	$T_{1,4}$	$T_{2,4}$	$T_{3,5}$
6	Global Financial Crisis	Sep-08	-	$T_{1,5}$	$T_{2,5}$	$T_{3,6}$
7	Sarinah Bombing	Jan-15	Atmanegara, Suhartono & Atok (2019)	$T_{1,6}$	$T_{2,6}$	$T_{3,7}$
8	The Eruption of Mount Raung	Aug-15	Mangindaan & Krityakierne (2018)	$T_{1,7}$	-	-
9	The Eruption of Mount Rinjani	Nov-15	Mangindaan & Krityakierne (2018)	$T_{1,8}$	-	-
10	The Eruption of Mount Agung	Nov-17	-	$T_{1,9}$	-	-
11	COVID-19 pandemic	Jan-20	-	$T_{1,10}$	$T_{2,7}$	$T_{3,8}$

Source: summarized from relevant previous studies

graphs of international visitor arrivals. Then the modeling using multi input intervention analysis of international visitor arrivals to Indonesia is carried out for each main port of entry using procedures described in the previous section. The magnitude and the pattern of impact of intervention events will be compared according to the type of intervention and point of entry.

4.1. Intervention Model at Ngurah Rai Airport

Ngurah Rai Airport is the main entrance to Indonesia that is located in Bali and one of the best tourist destinations in the world. Foreign tourist visits have increased since 1999. In early 1999, there were only 100 thousand visits per month. Ten years later, starting in 2009, the average number of visits has increased to 200 thousand visits per month. Since 2014, the increase in foreign tourist visits has become increasingly significant. The highest number of foreign tourist visits occurred in the 2018 and 2019 holiday seasons. In July and August, for two consecutive years, there were more than 600 thousand visits per month, showing the good development of tourism in Bali.

During January 1999 to August 2020, there were ten intervention events that might have an impact on the number of international visitor arrivals via Ngurah Rai Airport, shown by red dashed lines in Figure 2. Visually, negative impacts appeared during or after the intervention, especially during the 9/11 Attack; Bali Bombing 1 and 2; and the Eruption of Mount Raung, Rinjani, and Agung. During the COVID-19, Bali tourism experienced a significantly sharp decline. Observed from May to August 2020, the number of visits was below 100 per month.

First, the ARIMA Box-Jenkins procedure was conducted for pre-intervention modeling including the identification, parameter estimation, diagnostic checking and forecasting using the data obtained from January 1999 to August 2001. The identification process shows that the data need to be regular ($\mathrm{d} = 1$) and seasonal ($\mathrm{D} = 1$, $\mathrm{S} = 12$) differenced since they are not stationary in mean. The autocorrelation function (ACF) and partial autocorrelation function (PACF) plots of stationary data for pre-intervention modeling are presented in Figure 3.

According to the significant lags in the aforementioned ACF and PACF plots, the possible ARIMA model are ARIMA$(0,1,0)(2,1,2)^{12}$ and ARIMA$(0,1,0)(0,1,2)^{12}$. Observed from the parameter estimation process, the most appropriate model is ARIMA$(0,1,1)(0,1,1)^{12}$ since the significant lag in ACF plot tends to be cut off and the significant lag in PACF plot dies down. The ACF at lag 1 is significant although visually does not exceed the confidence interval. Thus, the pre-intervention model for monthly international visitor arrivals via Ngurah Rai Airport can be written as:

$$\mathrm{Y}_{1,\mathrm{t}} = \frac{(1 - 0.32790\mathrm{B})(1 - 0.93178\mathrm{B}^{12})}{(1 - \mathrm{B})(1 - \mathrm{B}^{12})}\mathrm{a}_{\mathrm{t}} \quad (4)$$

In the process of diagnostic checking, the residuals produced by this model are already in the form of white noise and normally distributed. Next, forecasting was performed at the time when the 1st intervention event, the 9/11 Attack, occurred at September 2001 to one month prior to the 2nd intervention event at September 2002 ($\mathrm{T}_{1,1}, \mathrm{T}_{1,1} + 1, \mathrm{T}_1, 1 + 2, \ldots, \mathrm{T}_{1,2} - 1$). Therefore, the response values for the 1st intervention are produced based on the difference between the actual data and previous forecast values to determine the order of b, s, and r that depicts the impact of the 9/11 Attack on the monthly international visitor arrivals via Ngurah Rai Airport. Based on the response values that exceed the confidence intervals in Figure 4, the assumed order is $\mathrm{b} = 1$, $\mathrm{s} = 1$, and $\mathrm{r} = 0$ for the 1st intervention model. The order of $\mathrm{b} = 1$ means that the impact of the 9/11 Attack does not directly affect the number of international visitor arrivals at September 2001, yet it is delayed for 1 month instead (October 2001). The order of $\mathrm{s} = 1$ means that, after starting at October 2001, the impact needs 1 month (November 2001) to be stable.

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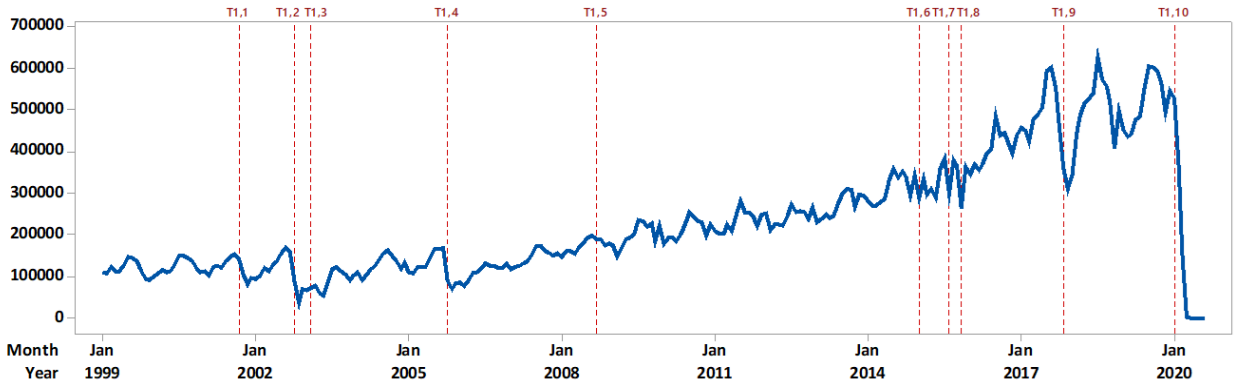

Figure 2. Time Series Plot of Monthly International Visitor Arrivals via Ngurah Rai Airport
Source: BPS, calculated by authors

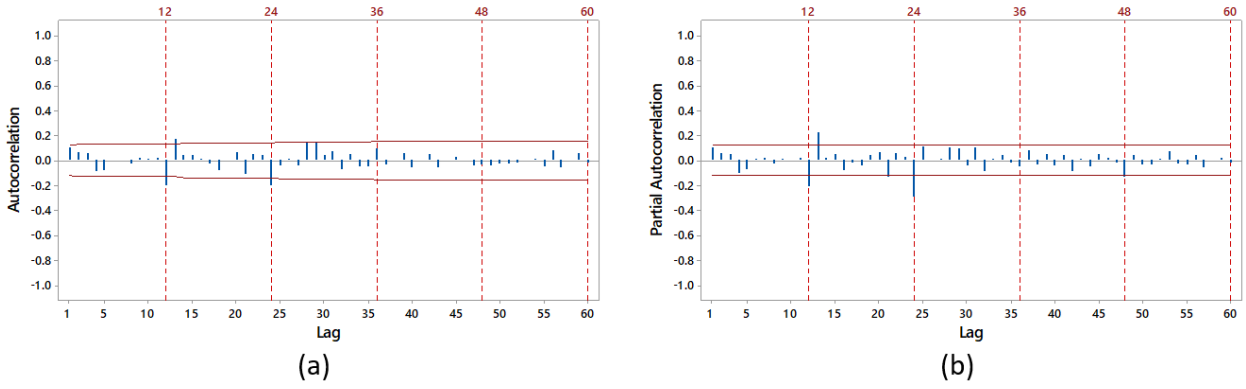

Figure 3. ACF (a) and PACF (b) Plots of Stationary Data for Pre-Intervention Modeling After Regular and Seasonal Differencing

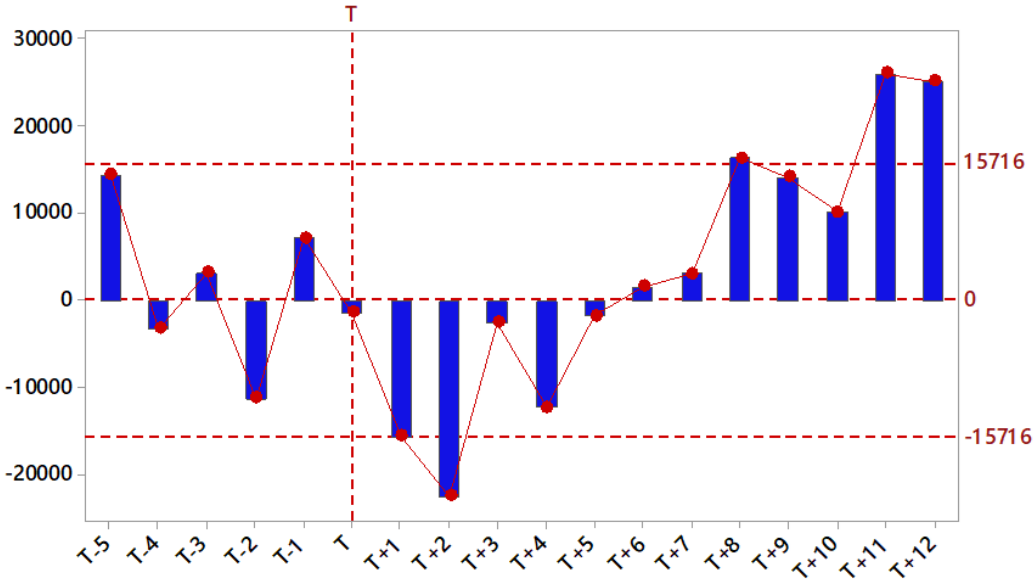

Figure 4. Response Values of the Monthly International Visitor Arrivals via Ngurah Rai Airport After the First Intervention

After parameter estimation and significance test, the 1st intervention model for the monthly international visitor arrivals via Ngurah Rai Airport can be written as:

$$\begin{aligned} Y_{1,t} &= -18793P_{1,t-1} - 22507P_{1,t-2} \\ &\quad + \frac{(1-0.1961B)(1-0.2542B^{12})}{(1-B)(1-B^{12})}a_t \quad (5) \end{aligned}$$

Following similar previous procedures, the 2nd until 10th intervention model for the monthly international visitor arrivals via Ngurah Rai Airport were constructed. The 10th or final intervention model is presented in Table 3. The estimation value of parameter from the previous intervention model is slightly different. As an example, the parameter of order $s = 1(\omega_{1_1})$ in the 1st intervention model is statistically significant then become insignificant and excluded from the 10th or final intervention model. In addition, there are insignificant parameter estimations of intervention model, namely i.e. ω_{0_1} and ω_{0_3}, that are not excluded from the model to show the impact of the related intervention event. The result of parameter estimations in Table 3 also can be written as follows,

$$\begin{aligned} Y_{1,t} &= -10658P_{1,t-1} - 30800P_{2,t} \\ &\quad -48093P_{2,t-1} + 9444P_{3,t} \\ &\quad -21229P_{3,t-3} - 49589P_{4,t} \\ &\quad -42482P_{4,t-1} - 28201P_{4,t-2} \\ &\quad -23921P_{5,t-5} - 24757P_{6,t} \\ &\quad +26798P_{6,t-1} - 35362P_{6,t-4} \\ &\quad -82777P_{7,t} - 63673P_{8,t} \\ &\quad -81374P_{9,t} - 188019P_{9,t-1} \\ &\quad -139242P_{9,t-2} - 40078P_{9,t-3} \\ &\quad -162311S_{10,t} - 199856S_{10,t-1} \\ &\quad -189582S_{10,t-2} - 40205S_{10,t-4} \\ &\quad -59033S_{10,t-5} \\ &\quad + \frac{(1-0.3467B)(1-0.6175B^{12})}{(1-B)(1-B^{12})}a_t \quad (6) \end{aligned}$$

Figure 5 shows that each response value or impact of intervention events generally has the same negative value, indicating that all intervention events can lead to a decrease in the number of international visitor arrivals via Ngurah Rai Airport but with different magnitude and pattern. Overall,

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Table 3. The Estimation Result of the Final Intervention Model for the Number of International Visitor Arrivals via Ngurah Rai Airport

Model	Parameter	Coef.	SE Coef.	t	P-value
ARIMA	θ_1	0.3467	0.0695	4.99	<.0001
	Θ_1	0.6175	0.0598	10.32	<.0001
1st Intervention	ω_{0_1}	-10658	12982	-0.82	0.4126
2nd Intervention	ω_{0_2}	-30800	13846	-2.22	0.0272
	ω_{1_2}	48093	13550	3.55	0.0005
3rd Intervention	ω_{0_3}	9444	12739	0.74	0.4593
	ω_{3_3}	21229	12748	1.67	0.0973
4th Intervention	ω_{0_4}	-49589	14059	-3.53	0.0005
	ω_{1_4}	42482	14673	2.9	0.0042
	ω_{2_4}	28201	13895	2.03	0.0436
5th Intervention	ω_{0_5}	-23921	12724	-1.88	0.0615
6th Intervention	ω_{0_6}	-24757	13537	-1.83	0.0688
	ω_{1_6}	-26798	13562	-1.98	0.0494
	ω_{4_6}	35362	12773	2.77	0.0061
7th Intervention	ω_{0_7}	-82777	12826	-6.45	<.0001
8th Intervention	ω_{0_8}	-63673	12880	-4.94	<.0001
9th Intervention	ω_{0_9}	-81374	15210	-5.35	<.0001
	ω_{1_9}	188019	16012	11.74	<.0001
	ω_{2_9}	139242	15998	8.7	<.0001
	ω_{3_9}	40078	14853	2.7	0.0075
10th Intervention	$\omega_{0_{10}}$	-162311	17620	-9.21	<.0001
	$\omega_{1_{10}}$	199856	18577	10.76	<.0001
	$\omega_{2_{10}}$	189582	17400	10.9	<.0001
	$\omega_{4_{10}}$	40205	17476	2.3	0.0224
	$\omega_{5_{10}}$	59033	17394	3.39	0.0008

Source: calculated by authors

the greatest drop occurred during the COVID-19 pandemic, exactly more than 600 thousand in July and August 2020 ($\mathrm{T}_{1,10}+6$ and $\mathrm{T}_{1,10}+7$), and during the Eruption of Mount Agung with more than 200 thousand drops in December 2017 ($\mathrm{T}_{1,9}+1$). In contrast, the smallest drop occurred during the 9/11 Attack, exactly no more than 20 thousand in December 2001 ($\mathrm{T}_{1,1}+3$). This proves that the 9/11 Attack intervention event is not statistically significant since it has a P-value$>\alpha$=0.10 in the final model (Table 2).

Based on the pattern, the terrorism event had no delayed impact on the number of international visitor arrivals via Ngurah Rai Airport and the significant impact only appeared for several months. In more detail, during Bali Bombing 1 and 2, the significant impact only appeared for one month and two months after these interventions occurred, respectively. The significant impact of Sarinah Bombing did not appear until four months later. As for the 9/11 Attack, the biggest impact appeared three months after this intervention although it was insignificant as previously stated. Global Financial Crisis also had no delayed impact though the impact was considerably small. The biggest impact appeared five months after this event, yet insignificant in the final model. The immediate impact was also showed by the Eruption of Mount Raung, Rinjani, and Agung as natural disasters, resulting in the closure of the airport. The impact caused by the Eruption of Mount Raung and Rinjani only appeared at the time of the intervention event. Meanwhile, the impact caused by the Eruption of Mount Agung was experienced longer, lasting for three months. The biggest impact appeared one month after the intervention event since the Eruption of Mount Agung occurred at the end of the month, namely November 27, 2017. The significant impact caused by SARS outbreak was only experienced three months after the intervention. Whereas, the COVID-19 pandemic that recently occurs has a gradually decreasing pattern of impact starting from January 2020.

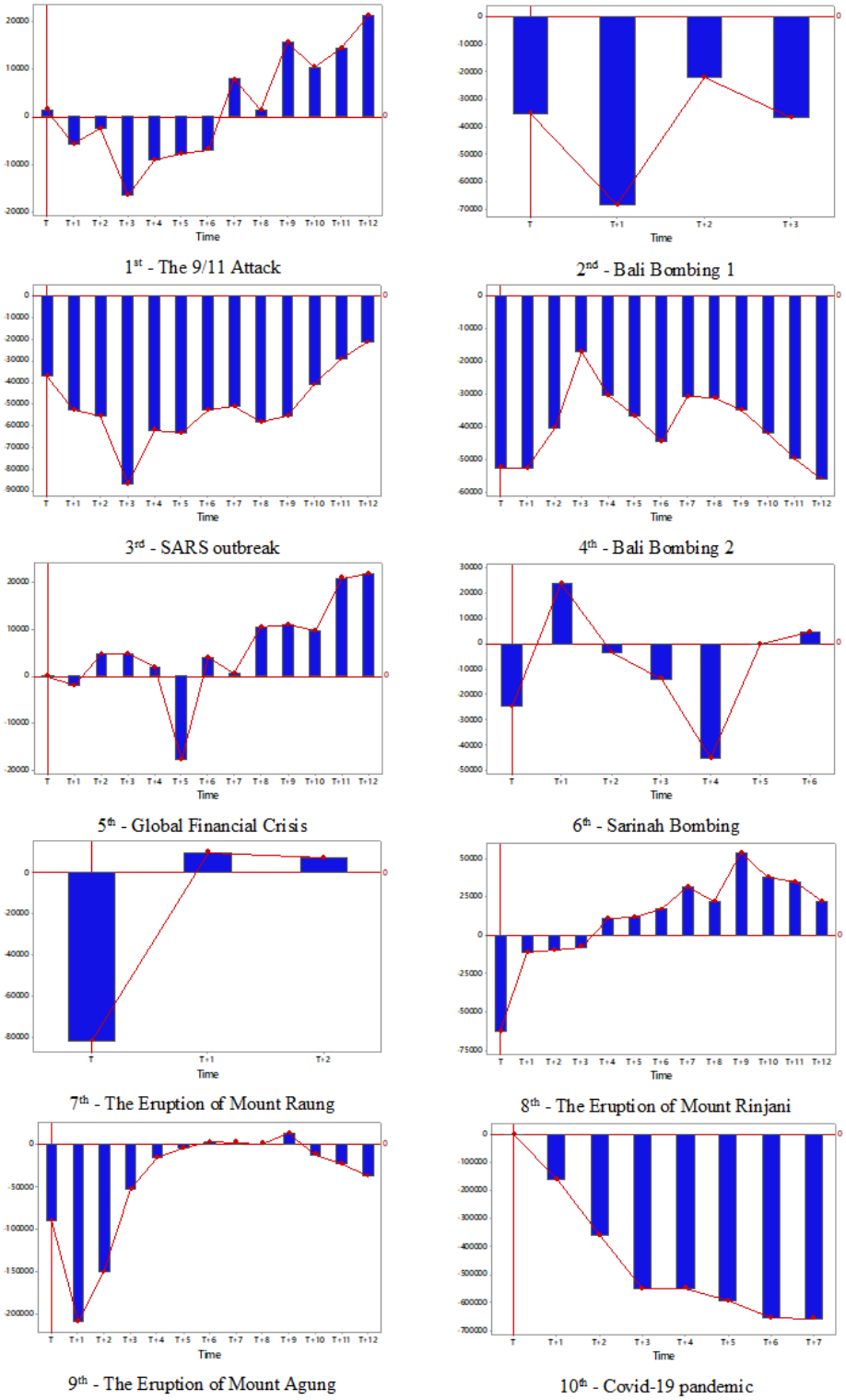

Figure 5. Response Values of the Monthly International Visitor Arrivals via Ngurah Rai Airport at the 1st to 10th Intervention Event

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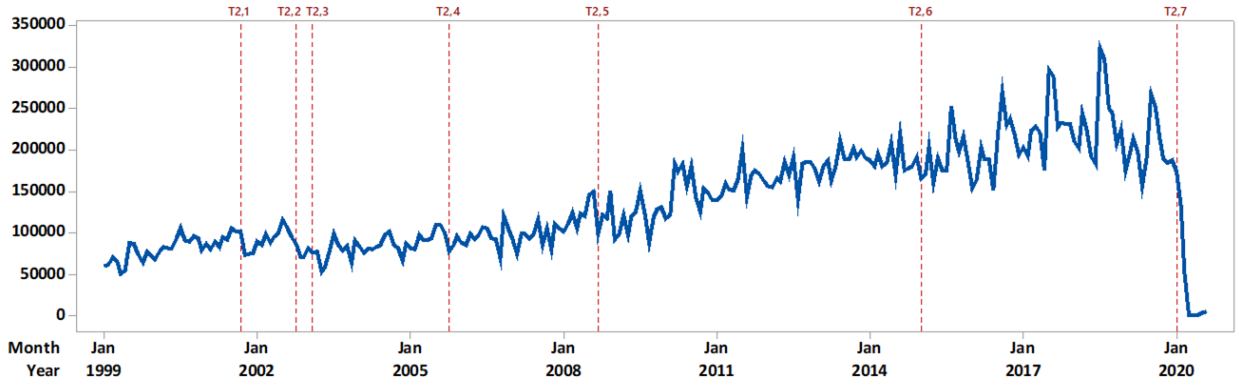

Figure 6. Time Series Plot of Monthly International Visitor Arrivals via Soekarno-Hatta Airport
Source: BPS, calculated by authors

4.2. Intervention Model at Soekarno-Hatta Airport

Soekarno-Hatta Airport is the second largest entrance after Bali. This entrance is located in the capital city of Indonesia. Figure 6 shows that, in general, the number of foreign tourist visits through Soekarno-Hatta Airport from January 1999 to August 2020 tends to increase. The highest number of foreign tourist visits occurred during the 2018 holiday season. In July 2018, there were more than 320 thousand visits. Meanwhile, the lowest visits happened during the COVID-19 pandemic, similar to Ngurah Rai Airport. In May 2020, there were less than 400 visits, marking it as the lowest visit since 1999.

There were seven intervention events that might have an impact on the number of international visitor arrivals via Soekarno-Hatta Airport (Figure 6). The negative impacts clearly appeared during or after these seven intervention events, with the biggest impact was caused by COVID-19 Pandemic starting January 2020, resulting in the extreme decrease in the number of international visitor arrivals via Soekarno-Hatta Airport.

The procedures used to construct the intervention model in this and the next sub-section are similar to those used to construct the intervention model of the number of the international visitor arrivals via Ngurah Rai Airport. They will not be shown explicitly.

The ARIMA model obtained for the pre-intervention model is ARIMA$(1,1,1)(0,1,0)^{12}$ and the 7th or final intervention model for the number of international visitor arrivals can be written as follows,

$$\begin{aligned}
\mathrm{Y}_{2,\mathrm{t}} \;=\; & -19769\mathrm{P}_{1,\mathrm{t}-1} + 2729\mathrm{P}_{2,\mathrm{t}-1} \\
& -21791\mathrm{P}_{3,\mathrm{t}-2} - 21106\mathrm{P}_{3,\mathrm{t}-3} \\
& -4767\mathrm{P}_{4,\mathrm{t}-12} + 27011\mathrm{P}_{4,\mathrm{t}-13} \\
& -21113\mathrm{P}_{5,\mathrm{t}} - 24703\mathrm{P}_{5,\mathrm{t}-4} \\
& -23256\mathrm{P}_{5,\mathrm{t}-5} - 34761\mathrm{P}_{5,\mathrm{t}-6} \\
& -43263\mathrm{P}_{5,\mathrm{t}-7} - 31648\mathrm{P}_{5,\mathrm{t}-8} \\
& -28810\mathrm{P}_{5,\mathrm{t}-12} + 3850\mathrm{P}_{6,\mathrm{t}-5} \\
& +19211\mathrm{P}_{6,\mathrm{t}-7} + 21942\mathrm{P}_{6,\mathrm{t}-8} \\
& +28925\mathrm{P}_{6,\mathrm{t}-10} + 35712\mathrm{S}_{7,\mathrm{t}} \\
& -63641\mathrm{S}_{7,\mathrm{t}-1} - 96379\mathrm{S}_{7,\mathrm{t}-2} \\
& -35030\mathrm{S}_{7,\mathrm{t}-3} + 40301\mathrm{S}_{7,\mathrm{t}-4} \\
& -32863\mathrm{S}_{7,\mathrm{t}-5} - 74902\mathrm{S}_{7,\mathrm{t}-6} \\
& +16897\mathrm{S}_{7,\mathrm{t}-7} + 38044\mathrm{I}_{\mathrm{t}}^{(116)} \\
& + \frac{(1-0.6834\mathrm{B})}{(1-\mathrm{B})(1-\mathrm{B}^{1}2)}\mathrm{a}_{\mathrm{t}} \qquad (7)
\end{aligned}$$

with an addition of an outlier $\mathrm{I}_{\mathrm{t}}^{(116)} = 1$ at $\mathrm{t} = 116$ and $\mathrm{I}_{\mathrm{t}}^{(116)} = 0$ at $\mathrm{t} \neq 116$ to make the residuals of this final intervention model normally distributed. Different from the pre-intervention model, the parameter of seasonal MA with order $\mathrm{Q} = 1$ becomes insignificant in the final intervention model.

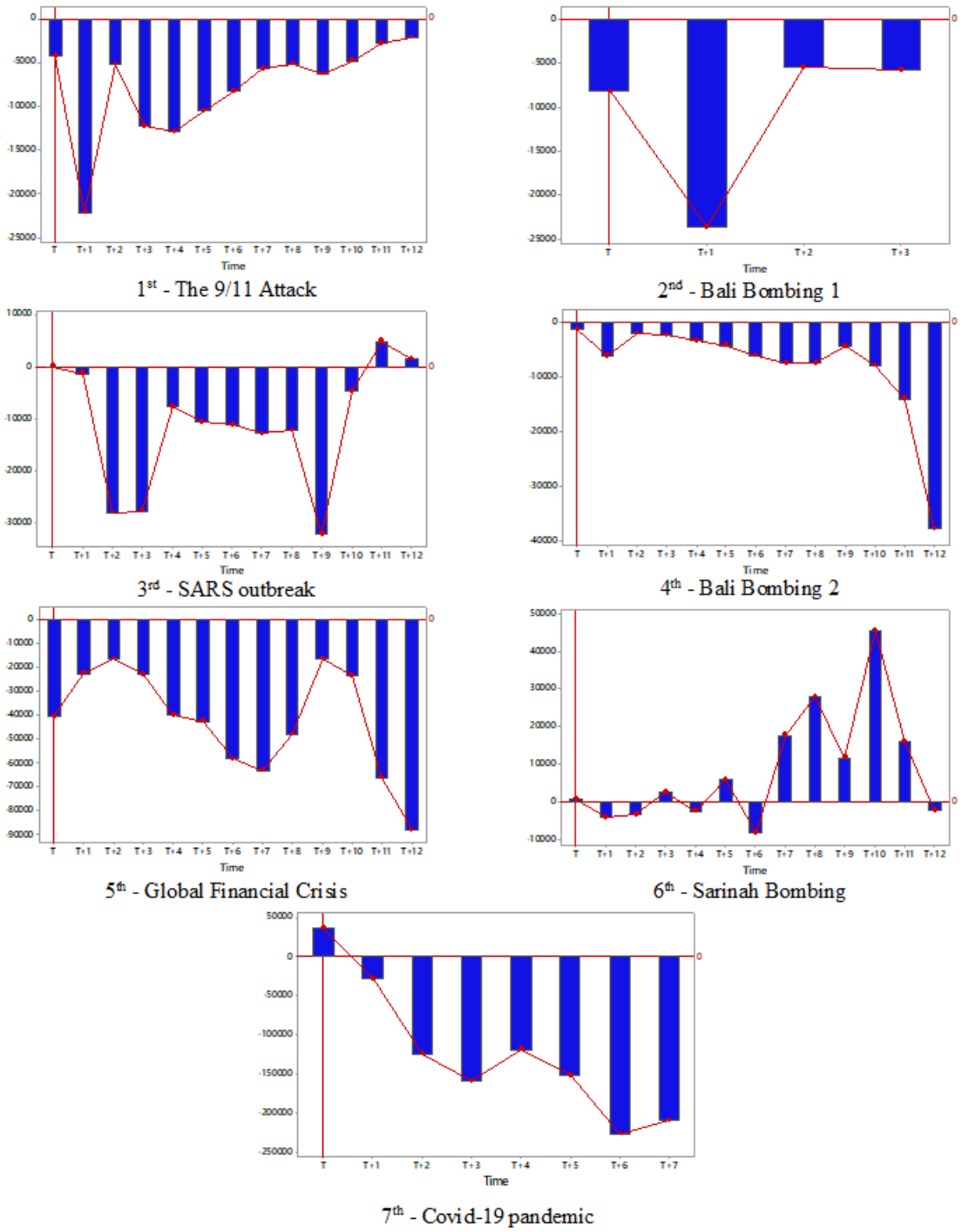

Figure 7. Response Values of the Monthly International Visitor Arrivals via Soekarno-Hatta Airport in the 1st to 7th Intervention Event

Source: BPS, calculated by authors

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Generally, the response values of intervention events show a negative impact on the number of international visitor arrivals via Soekarno-Hatta Airport, except Sarinah Bombing that has a significant positive impact, i.e. seven ($\mathrm{T}_{2,6}+7$), eight ($\mathrm{T}_{2,6}+8$) and ten ($\mathrm{T}_{2,6}+10$) months after the intervention event. The COVID-19 pandemic causes the largest decline in foreign tourist arrivals in the last 20 years. In July and August 2020 ($\mathrm{T}_{2,7}+6$ and $\mathrm{T}_{2,7}+7$), the decline was almost 250 thousand visits. The decline in foreign tourists caused by COVID-19 outbreak did not immediately occur, but rather started in February 2020. The decline reached 150 thousand visits in April and June, then peaked in July 2020. Another pandemic, namely SARS, also causes a negative impact. In the same pattern as the impact of COVID-19, the decline in foreign tourists did not immediately occur in $\mathrm{T}_{2,3}$. After a month delay, there was a decrease in visits. The peak of the decline in visits occurred for two months, i.e in April and May 2003.

Global Financial Crisis also dropped the number of international visitor arrivals. The immediate decline occurred in September 2008 ($\mathrm{T}_{2,5}$). There is no need for time delays to reduce the number of foreign tourist arrivals through Soekarno-Hatta Airport. Significant impacts occurred for a year. Apart from pandemics and crises, terrorism and bombings also had negative impacts. The 9/11 Attack, Bali Bombing 1 and 2, and Sarinah Bombing resulted in a decrease in the number of foreign tourist visits. The 9/11 Attack and Bali Bombing 1 occurring in the middle of the month, on September 11, 2001 and October 12, 2002, respectively, had no immediate effect. Following a delay of 1 month, there was a decrease in foreign tourist visits. At the initial period of the intervention event, the impact of Bali Bombing 1 was greater than Bali Bombing 2. One month after Bali Bombing 1, Soekarno-Hatta Airport lost nearly 25 thousand foreign tourists. Observed from Bali Bombing 2, the greatest impact occurred 12 months after the intervention, leading to a decrease in the number of foreign tourists by nearly 40 thousand. Sarinah Bombing did not have a significant negative impact. Interestingly, five months after the incident, the number of tourists increased.

4.3. Intervention Model at Batam Port

In contrast to the two previous ports of entry by air, Batam port is a port of entry by sea. In general, the number of foreign tourists visiting Batam from January 1999 to August 2020 has fluctuated and tended to increase. During the research period, the highest number of visits by foreign tourists occurred in December 2018, namely more than 233 thousand visits. Meanwhile, the lowest occurred in April 2020, only a thousand hundred visits. Figure 8 shows nearly 100 thousand visits per month in early 1999. At the end of 2019, however, the number of visits averaged 150 thousand visits per month. Then it started to decline in February and March 2020, and decreased sharply since March 2020, only around a thousand visits per month.

The eight interventions are estimated to affect the number of foreign tourists visiting Batam Port. Based on Figure 8, it can be seen that there has been a significant decline in the number of tourists since the beginning of 2020. This negative impact is thought to have arisen due to the global pandemic, COVID-19. In addition, in April 2003, the number of foreign tourists visiting also decreased. This decline is estimated to be due to the closure of gambling sites in Batam.

The interventions were modeled using the same procedure as in section 4.1. Figure 9 shows the response values of monthly international visitors via the Batam Port after the first intervention. This figure is different compared to Figure 4 that has a response value that exceeds the $\pm 2\sigma$ confidence interval to determine the order of b, s, and r. Starting from the 9/11 Attack ($\mathrm{T}_{3,1}$) until the next year ($\mathrm{T}_{3,1}+12$), there was a decrease in the number of foreign tourists. This is indicated by a bar chart that is below 0. However, the decrease does not exceed the $\pm 2\sigma$ confidence interval. Thus, the 9/11 Attack cannot be said to have statistically intervened in foreign

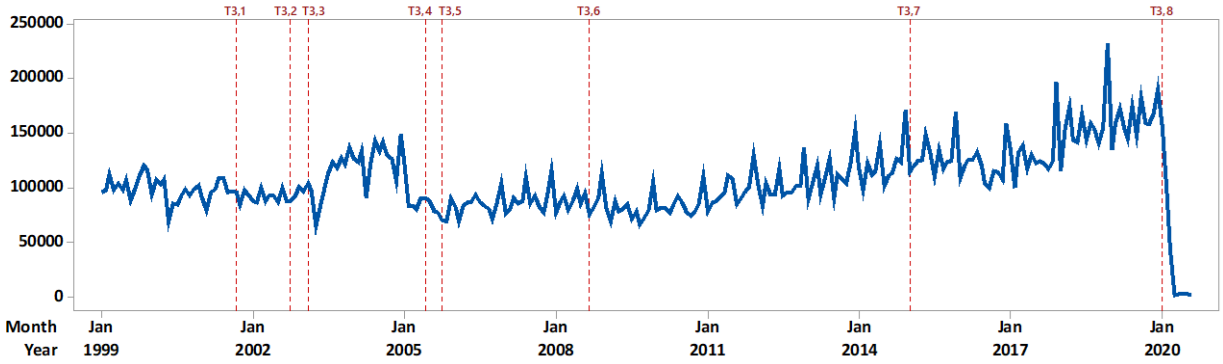

Figure 8. Time Series Plot of Monthly International Visitor Arrivals via Batam Port
Source: BPS, calculated by authors

tourist visits to Batam Port. The first intervention ($\mathrm{T}_{3,1}$) can not be included in the model.

Response values of the monthly international visitor arrivals via Batam Port after the second to eight interventions have been calculated. There are five intervention events that statistically do not interfere with foreign tourists visiting Batam Port, i.e. the 9/11 Attack ($\mathrm{T}_{3,1}$), Bali Bombing 1 ($\mathrm{T}_{3,2}$), Bali Bombing 2 ($\mathrm{T}_{3,5}$), Global Financial Crisis ($\mathrm{T}_{3,6}$), and Sarinah Bombing ($\mathrm{T}_{3,7}$). Therefore, only SARS outbreak ($\mathrm{T}_{3,3}$), the Closure of Gambling Location ($\mathrm{T}_{3,4}$), and COVID-19 pandemic ($\mathrm{T}_{3,8}$) are used in the modeling. The final intervention model is written as,

$$\begin{aligned}\mathrm{Y}_{3,t} &= 18450\mathrm{P}_{3,t} - 21005\mathrm{P}_{3,t-2} \\ &\quad -20589\mathrm{P}_{3,t-3} - 11968\mathrm{P}_{4,t-2} \\ &\quad -2323\mathrm{P}_{4,t-3} + 28898\mathrm{S}_{8,t} \\ &\quad -91668\mathrm{S}_{8,t-1} - 67109\mathrm{S}_{8,t-2} \\ &\quad -20085\mathrm{S}_{8,t-3} + 7437\mathrm{S}_{8,t-4} \\ &\quad -28060\mathrm{S}_{8,t-5} + 25831\mathrm{S}_{8,t-6} \\ &\quad -28719\mathrm{S}_{8,t-7} \\ &\quad + \frac{(1-0.5731\mathrm{B})}{(1-\mathrm{B})(1-\mathrm{B}^{12})(1-0.3493\mathrm{B})^{12}}\mathrm{a}_t \end{aligned} \quad (8)$$

The impact of all three intervention events is shown in Figure 10. This figure shows that there has been a decrease in foreign tourist visits to Batam Port after the intervention. The biggest decline was caused by the COVID-19 pandemic, followed by the closure of gambling sites and SARS. The COVID-19 pandemic has the deepest decreasing impact. One month following the COVID-19 outbreak, the number of foreign tourist visits to Batam Port decreased significantly. In February, the number of foreign tourists fell by more than 50 thousand visits and this reduction just got worse. In June 2020, the number of foreign tourists visiting fell to nearly 200 thousand visits. Until August, this condition had not improved.

Figure 10 shows a significant decrease in the number of foreign tourist visits in August and September 2005 ($\mathrm{T}_{3,4}+2$) and ($\mathrm{T}_{3,4}+3$) as an impact of the Closure of Gambling Sites. The gambling locations were closed after the inauguration of the National Police Chief Sutanto in June 2005. A slight decline began to occur in June and July. At its peak, in July and August, the number of foreign tourists visiting decreased by nearly 30 thousand visits. SARS that broke out in February 2003 lowered foreign tourists visiting Batam Port in April and May 2003 ($\mathrm{T}_{3,3}+2$) and ($\mathrm{T}_{3,3}+3$). The decline occurred for two months only. Starting in June, the visits of foreign tourists slowly began to show an increase along with the end of the SARS outbreak.

5. Conclusion

An intervention event does not always have a significant impact on the number of international visitor

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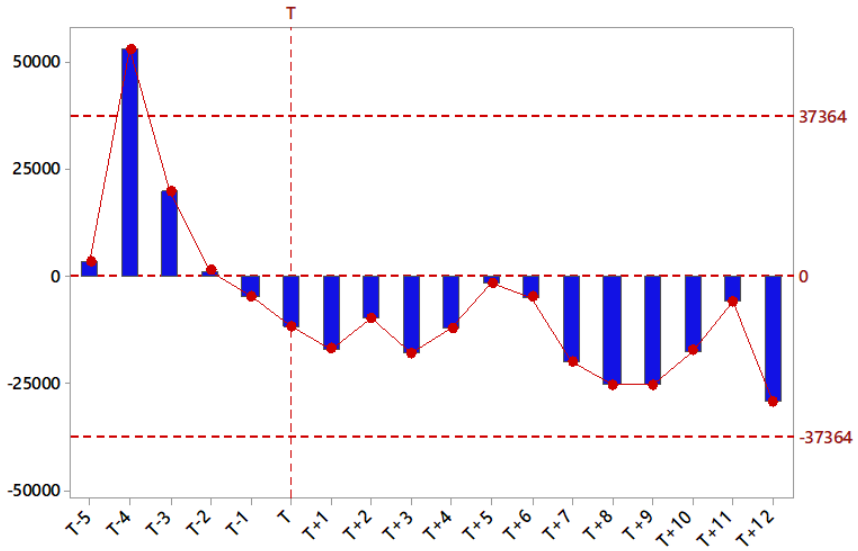

Figure 9. Response Values of the Monthly International Visitor Arrivals via Batam Port after the First Intervention

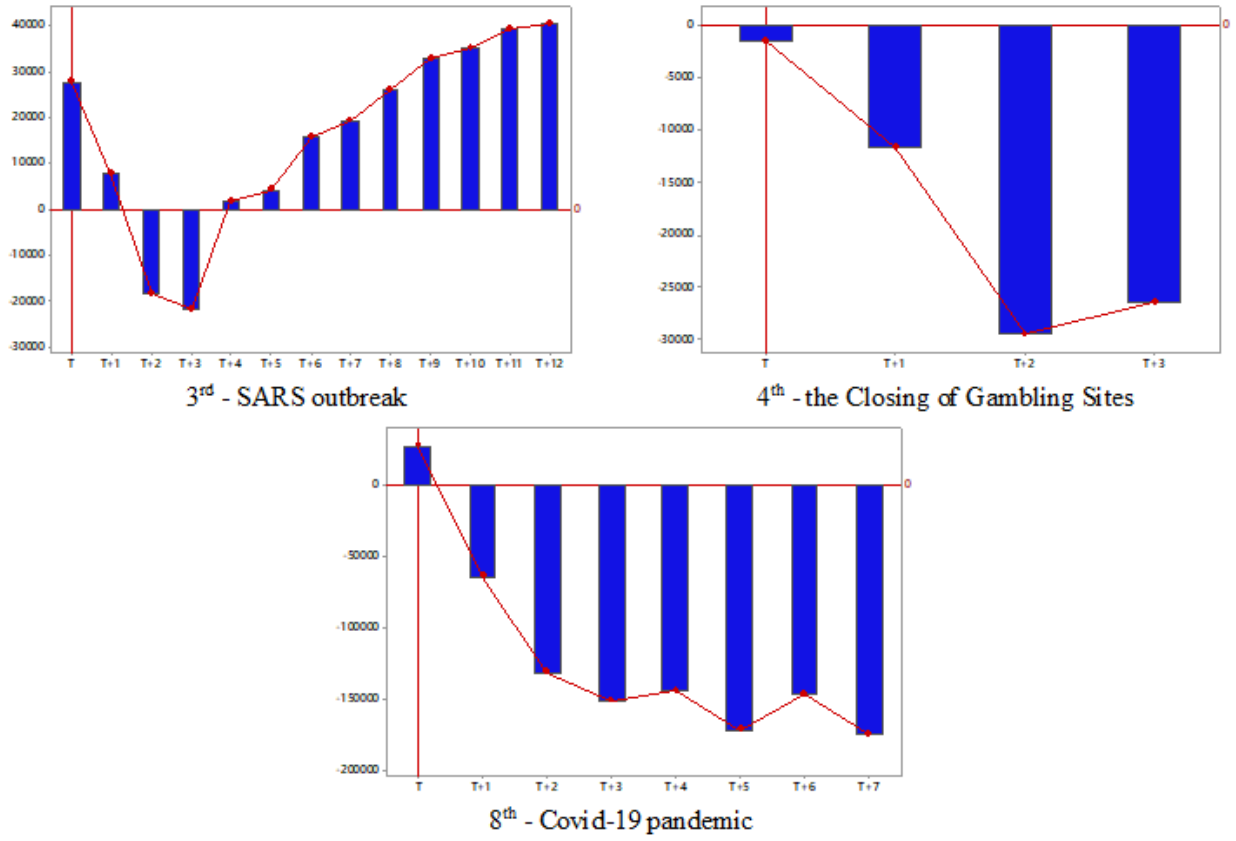

Figure 10. Response Values of the Monthly International Visitor Arrivals via Batam Port at the 3rd, 4th, and 8th Intervention Event

arrivals at the three main ports of entry. As shown by the results of the previous section, the 9/11 Attack only has a significant impact on the number of international visitor arrivals via Soekarno-Hatta Airport. The negative impact appears but is not quite significant so that the intervention event is excluded in the final model of Batam Port. The intervention of Bali Bombing 1 only has a significant impact on the number of international visitor arrivals via Ngurah Rai Airport. Bali Bombing 2, Global Financial Crisis and Sarinah Bombing have no significant impact on the number of international visitor arrivals via Batam Port.

Generally, all intervention events can lead to a decrease in the number of international visitor arrivals but with different magnitude and pattern, except for Sarinah Bombing that has a positive impact. Overall, the biggest decline and longest impact are caused by COVID-19 pandemic compared to the other intervention events. The port of entry experiencing the most decline is Ngurah Rai Airport, followed by Soekarno-Hatta Airport and Batam Port. The impact of COVID-19 pandemic still occurs without any indication that the impact is diminishing.

According to the response values or patterns of impact from the previous section, generally, all the intervention events have delayed impact with varied length, except for terrorism and natural disasters, i.e. Bali Bombing 1 and 2, Sarinah Bombing, the Eruption of Mount Raung, Rinjani and Agung, that give a direct impact on the number of international visitor arrivals via Ngurah Rai Airport. This conclusion confirms the results of previous studies by Mangindaan & Krityakierne (2019). Moreover, these results also indicate that the international visitor arrivals via Ngurah Rai Airport are more sensitive to terrorism and natural disasters than international visitor arrivals via Soekarno-Hatta Airport and Batam Port. In this study, the SARS outbreak actually has a delayed impact, in contrast to the results of the study by Mangindaan & Krityakierne (2018) that used the same data.

Observed from international visitor arrivals via Soekarno-Hatta Airport, this study shows that Bali Bombing 1 and 2 have a delayed impact, quite similar to the result of the study by Lee, Suhartono & Sanugi (2010). In more detail, the delay of the impact of Bali Bombing 2 even takes up to 12 months after this intervention. This indicates that a terrorist attack in one area does not always has a direct impact on other areas. Regarding the closure of gambling sites, this study shows a delayed impact of two months after this intervention event, in contrast to the study by Atmanegara, Suhartono & Atok (2019) that showed a direct impact.

The impact of Global Financial Crisis on international visitor arrivals via Soekarno-Hatta Airport is more continuous up to one year while it is only temporary via Ngurah Rai Airport, namely five months after the intervention event. In terms of COVID-19 pandemic that begins in January 2020, the impact of a deeper decline is experienced by international visitor arrivals via the three main ports of entry one month later. Observed from these results, the intervention events utilized in this study, occurring in more than twenty years, have different magnitude and patterns of impact according to the type and port of entry.

The results of this research can be used as mitigation support for the government, especially the ministry of tourism. The related parties can anticipate earlier when facing similar intervention events in the future. In addition, it can also be used as a basis for carrying out resource efficiency in the tourism sector when an intervention event occurs. The results of this research are expected to support the data in determining tourism promotion policies, especially in Indonesia.

For future studies, it is necessary to observe the performance of tourism, especially for international visitor arrivals from the demand side. This can be done by modeling the number of international visitor arrivals from a certain country. The modeling should regard the intervention events that occur in the country of origin. Furthermore, positive interventions such as tourism promotion also need to be considered in the model, such as in the study by Atmanegara, Suhartono & Atok (2019) that used the

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intervention of sharia tourism promotion in October 2013. That will be significantly useful as an evaluation of the government's performance in promoting the tourism sector.

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