

## Research Article

### Malaysia's Efficiency in Dealing with COVID-19 Outbreaks Compared to Other Asian Countries by Using Stochastic Frontier Analysis (SFA)

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#### Abstract

**Objective:** This study has been done to assess Malaysia's effectiveness in handling COVID-19 compared to other countries in South East Asia.

**Methods:** Stochastic Frontier Analysis is capable of compiling the effectiveness of dealing with COVID-19 outbreaks according to its function and not using a specific distribution function. The highest technical efficiency score is the most efficient and reflects the ability of the country to deal with the COVID-19 outbreak, which is very well without any problems. Results: Thailand was shown to be ranked 1 (TE = 0.88341) with a technical efficiency score higher than most other countries. The score for second place is Malaysia with a technical efficiency score of TE = 0.88338, the third place score is Indonesia (TE = 0.83342) and last position is Philippine (TE = 0.67706).

**Conclusions:** Ministry of Health took the implementation of MCO, and action did put Malaysia as the second most effective country in Southeast Asia in managing COVID-19 infection. This data hopefully, could benefit Malaysia and all other countries to handle this COVID-19 epidemic.

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**Keywords** | COVID-19, Malaysia, ASEAN Countries, Stochastic Frontier Analysis, Technical Efficiency.

#### Introduction

Coronavirus 2019 (COVID-19) is the latest pandemic that affects the whole world. Wuhan has been reported as the epicentre of the disease. On January 30, 2020, it was declared a public health emergency by the World health organization (WHO). In June 2020, the disease's epicentre has been shifted to the United States of America, which reported more than 4 million cases and more than 200 000 deaths. COVID-19 had infected 8 860 331 people worldwide and caused a total of 465 740 deaths as of June 22, 2020. Southeast Asia, situated near the epicentre of the virus, recorded 600 191 cases of COVID-19, and

17 734 deaths were reported.<sup>1</sup>

The first confirmed case of COVID -19 in South East Asia was reported in Thailand on January 13, 2020. A Chinese woman who is a resident of Wuhan with symptoms of sore throat and fever was detected using thermal surveillance at the airport, later tested to be positive of the infection. On January 23, 2020, Singapore confirmed its first case followed by Malaysia, who declared its first case of COVID -19 on January 25, 2020 after testing a close contact of positive cases Chinese nationals who are coming to Malaysia from Singapore.<sup>2,3</sup> The Philippines confirmed the first case of COVID -19 on January 30, 2020,

and Indonesia reported its first case on March 2, 2020.<sup>4,5</sup> Although Indonesia reported the first case later compared with the other ASIAN countries, it is the hardest country hit by the disease, with 45 891 confirmed cases and 2465 deaths reported on June 22, 2020.<sup>1</sup>

Once WHO announced that COVID -19 is the world Pandemic on March 11, 2020, Malaysia had implemented an early intervention to prevent it from spreading. Among the earliest efforts taken by the Ministry of health to prevent disease transmission was the enforcement of health screening at all entry points to the country.<sup>6</sup> Ministry of health also had an increased number of hospitals and facilities that could manage COVID-19 cases. On March 18, 2020, Movement control order (MCO) was started to flatten the COVID -19 infection curve. It was a local version of the Malaysian government's lockdown where mass movement and gathering, including religious and social activity, were prohibited across the country. The order enforced came under the Prevention and Control of Infectious Diseases Act 1988 and the Police Act 1967. Ministry of Health also did an aggressive test and screening for close contact of COVID -19 cases by closely working with the police to locate possible carriers of the virus, identifying them, carrying out testing, and imposing a 14-day self-quarantine.<sup>6</sup>

One day before the implementation of MCO, Malaysia had the highest number of positive COVID-19 cases among the Association of Southeast Asian Nations (ASEAN) countries with daily cases of more than 100. However, with the Ministry of Health's effective measures with strong support from the Malaysian government, the cases of COVID -19 had dropped drastically as on June 22, 2020, the number of positive cases is 8572. Malaysia also had low number of death due to the infection. 121 death was reported due to COVID -19 up until June 2020, and it is among the lowest number of deaths in South East Asia.<sup>1,7</sup>

This study has been done to assess Malaysia's effectiveness in handling COVID-19 compared to other countries in South East Asia. Three main variables used in this study are the number of positive COVID-19 cases, the number of deaths due to the infection and the number of cured cases. By comparing among

the regional country, this study could benefit other countries, especially country that is still struggling in combat with the COVID-19 to learn from the country that was successfully and effectively containing the virus.

## Methods

This study was conducted by reviewing the daily data published by Worldometers.info: COVID-19 Coronavirus Pandemic starting from February 15 until June 13, 2020.<sup>24</sup> The variables identified in this study are the cumulative number of positive cases of COVID-19, the total number of death cases of COVID-19 and the total number of recoveries of COVID-19. Countries with no death cases of COVID-19 have been excluded from this study, such as Vietnam, Cambodia, Laos and Timor-Leste. Statistical analysis was performed by using SAS through Stochastic Frontier Analysis (SFA) and Excel software. This study's method is Stochastic Frontier Analysis (SFA) by using the model of Battese and Coelli.<sup>20</sup>

Stochastic Frontier Analysis is one of the simplest and most widely used supervised machine learning algorithms for efficiency analysis by data scientists. SFA is a way of modeling the economy. The parametric approach to estimating stochastic production frontiers was introduced by Aigner et al.<sup>19</sup>, Meeusen and van den Broeck<sup>22</sup>, and by Battese and Cora<sup>21</sup>. This method is capable of compiling the effectiveness of dealing with COVID-19 outbreaks according to its function and not using a specific distribution function. The characteristics of the method are appropriate for measuring the efficacy of COVID-19 outbreaks because it is arranged at the most efficient level. This is particularly useful when it comes to preventing and educating the public about the importance of good personal and family care. The findings of this study will enable other countries to track and prevent COVID-19 pandemics.

The stochastic frontier model which can be expressed as:

$$\ln Y_{it} = \beta_0 + \beta_1 \ln x_{2it} + \beta_2 \ln x_{3it} + (V_{it} - U_{it})$$

where,

$Y_{it}$  = Total positive cases of COVID -19 of the th i country in the th t time period

- $\beta$  = Vector of unknown parameters to be estimate
- $x_{1it}$  = Total death cases of COVID -19 of the th i country in the th t time period
- $x_{2it}$  = Total recoveries cases of COVID -19 of the th i country in the th t time period
- $U_{it}$  = Non-negative random variables, associated with technical inefficiency of total cases of COVID -19 of the country
- $V_{it}$  = Assumed to be independent and identically distributed (i.i.d)  $N(0, \sigma^2 v)$  and captures statistical noise, measurement error, and other random.

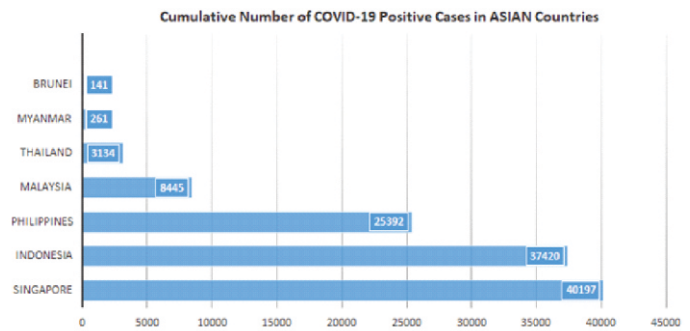
The maximum likelihood test is used to estimate the model's parameters and to forecast the technological efficiencies over time when dealing with COVID-19 outbreaks. This approach produces more satisfying results as more effective than the Ordinary Least Squares (OLS) method.<sup>23</sup> Parameters ( $\gamma$ ) must be between 0 and 1. The stochastic output function parameters calculated using the maximum likelihood estimation method and the measurement using the SAS as shown in Table 1.

**Table 1:** Country Wise Cases, Deaths & Recoveries of COVID-19

Sr. #	Countries	Positive	Deaths	Recoveries
1	Malaysia	7311	120	8445
2	Indonesia	13776	2091	37420
3	Thailand	2987	58	3134
4	Singapore	28808	26	40197
5	Philippine	5706	1074	25392
6	Myanmar	167	6	261
7	Brunei	138	2	141

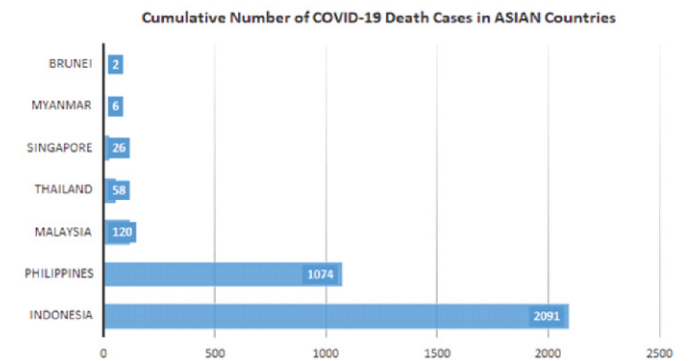
**Results**

The patterns of COVID-19 for cumulative number of COVID-19 positive cases in ASEAN countries from February 15 until June 13, 2020. Singapore saw its highest increase in a cumulative number of positive COVID-19 cases (40197 cases) to date. Second highest cumulative number of COVID-19 Positive cases in ASIAN countries is Indonesia (37420 cases) and follow by Philippine with 25392 cases. Malaysia has the fourth highest cumulative number of COVID-19 positive cases in ASIAN countries with 8445 cases, follow by Thailand (3134), Myanmar (261) and Brunei (141). (Figure 1)



**Figure 1:** The Cumulative Number of COVID-19 Positive Cases in ASEAN Countries from February 15 until June 13, 2020

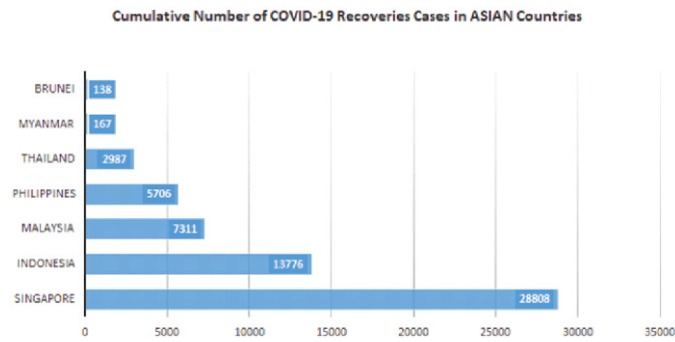
Figure 2 shown that the patterns of COVID-19 for cumulative number of COVID-19 death cases in ASIAN Countries from February 15 until June 13, 2020. Indonesia saw its highest increase in a cumulative number of death COVID-19 cases (2091 cases) to date. Second highest cumulative number of COVID-19 death cases in ASIAN countries is Philippine (1074 cases) and follow Malaysia with 120 cases. Thailand has the fourth highest cumulative number of COVID-19 death cases in ASIAN countries with 58 cases, follow by Singapore (26), Myanmar (6) and Brunei (2). (Figure 2)



**Figure 2:** The Cumulative Number of COVID-19 Death cases in ASEAN Countries from February 15 until June 13, 2020

The patterns of COVID-19 for cumulative number of COVID-19 recoveries cases in ASIAN countries from February 15 until June 13, 2020. Singapore saw its highest increase in a cumulative number of 19 recoveries COVID-19 cases (28808 cases) to date. Second highest cumulative number of COVID-19 recoveries in ASIAN countries is Indonesia (13776 cases) and followed by Malaysia with 7311 cases. Philippine has the fourth highest cumulative number of COVID-19 19 recoveries cases in ASEAN

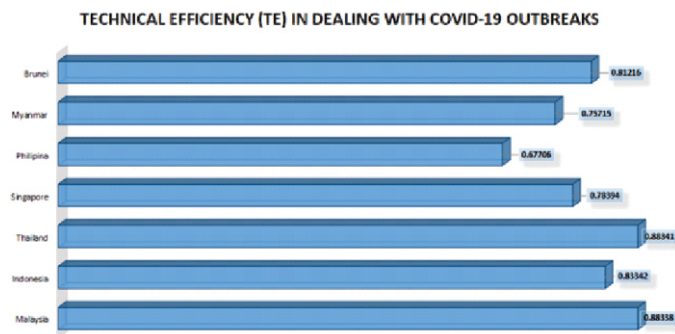
countries with 5706 cases, follow by Thailand (2987), Myanmar (167) and Brunei (138). (Figure 3)



**Figure 3:** The Cumulative Number of COVID-19 Recoveries Cases in ASIAN Countries from February 15 until June 13, 2020

**Table 2:** Technical Efficiency in Dealing with COVID-19 based on ASEAN Countries

Obs	Country	(TE)	Ranking
1	Malaysia	0.88338	2
2	Indonesia	0.83342	3
3	Thailand	0.88341	1
4	Singapore	0.78394	5
5	Philippine	0.67706	7
6	Myanmar	0.75715	6
7	Brunei	0.81216	4



**Figure 4:** Technical Efficiency (TE) in Dealing with COVID-19 Outbreaks Based on ASEAN Countries

This study discusses the outbreak of COVID-19 in the ASIAN country, where the highest technical efficiency score is the most efficient and reflects the ability of the country to deal with the COVID-19 outbreak, which is very well without any problems. Thailand was shown to be ranked 1 (TE = 0.88341) with a technical efficiency score higher than most other countries. The score for second place is Malaysia with a technical efficiency score of 0.88338. The third place score for COVID-19 is Indonesia with a technical efficiency score of

0.83342. The score for the last position is Philippine with a technical efficiency score of 0.67706 (rank 7). (Table 2)

## Discussion

Cumulative numbers of COVID-19 in Southeast Asia country from February 15 until June 13, 2020 were 439 348 cases<sup>8</sup> Singapore had the highest positive cases (40197 cases) reported followed by the Philippines (37420 cases). The surge of cases in Singapore started in April, and it is due to migrant workers living in dormitories. On April 20, Singapore had its highest daily cases of 1396 of COVID-19 from that cluster.<sup>9</sup> Following the drastic increment of cases, the Singapore government imposing a mandatory quarantine of 20,000 migrant workers in two dormitories gazette as isolation areas. Whereas in Malaysia, the total cases of COVID-19 were 8445 cases. It has its peak daily cases of 235 due to a new cluster (called Sri Petaling Cluster) on 26<sup>th</sup> March 2020 that Malaysian force government to implement MCO earlier from March 18 to March 31 and later was extended four-time into four phases until May 12, 2020.<sup>6,7</sup> Implementation of MCO seems to flatten the disease spreading curve and significantly reduce the COVID-19 transmission in Malaysia.<sup>10</sup>

COVID-19 causes 12 126 death in Southeast Asia country from February 15 until June 13, 2020.<sup>8</sup> The number of death the hardest-hit Indonesia due to COVID-19 in Southeast Asia country (2091 death). It represents a 5.6% death rate slightly higher than the death rate in China, which is 5.5%.<sup>8</sup> The high number of deaths in Indonesia might be due to the country's unpreparedness to face the pandemic.<sup>11</sup> According to the Ministry of Health Indonesia, there are only 309 100 hospital beds in Indonesia, and most of them are situated in Java island. There are only 2.7 ICU beds per 100 000 people in Indonesia, and there is a shortage of mechanical ventilators and protective gear for health workers, which may contribute to a high mortality rate.<sup>12</sup>

Malaysia recorded 120 death during that period and represented 1.4% of the death rate. The first two deaths in Malaysia were recorded on March 17, 2020 and one of them was associated with the Sri Petaling cluster.<sup>13</sup> Preparing for the worst-case and preventing the increasing number of deaths, the Malaysian

government and Ministry of Health increased the hospital number that could treat COVID-19 cases. Public hospital was joining forces with a private hospital, university hospital and Ministry of defence hospital to accommodate the increasing number of COVID-19 cases.<sup>6</sup> Ministry of Health had also set up a temporary hospital at Agro Exposition Park Serdang (MAEPS) in coordination with The National Disaster Management Agency. MAEPS was initially the largest convention center in Malaysia. This hospital was set up for treatment and quarantine areas for the low-risk patient.<sup>14</sup> This aggressive movement by the government had controlled the death rate due to COVID-19 in Malaysia.

Singapore shows the highest number of patients recovered from COVID-19 in Southeast Asia countries. From 40 197 cases reported, 28 808 cases recovered, which give 71.6% of recovery rate from the infection. Malaysia reported that 7311 people recovered from positive COVID-19 with a slightly better recovery rate of 86.6% compared to Singapore. A high number of recovered patients and a high number of recovery rate could reflect how prepared and how serious the country in combating pandemic COVID-19. Although cases of COVID-19 was high in Singapore, the number of recovered patients is high, and its number of deaths due to the disease was low. Singapore had learned from the outbreak of Severe acute respiratory syndrome (SARS), which hardly affected them in 2003. Singapore is among the earliest countries in Southeast Asia that implement border control measures, actively doing contact tracing and disease surveillance.<sup>15</sup> Similarly, in Malaysia, contact tracing and disease surveillance were done to every close contact to positive COVID-19 cases. All the close contact was being tested and quarantined.<sup>6</sup>

By measuring Technical Efficiency using Stochastic Frontier Analysis (SFA), we determined that Malaysia is the second most efficient country in handling COVID-19 cases (TE = 0.8833), just slightly behind its neighbour country Thailand (TE = 0.8834). Thailand had the earliest reported COVID-19 cases in Southeast Asia. The number of cases repeatedly increases in mid-March. The most significant cluster was reported happened at Lumpinee Boxing Stadium, following Muay Thai fight on March 6, 2020.<sup>16</sup> Following the increment of the positive case

number, the Thailand government declared a state of emergency on March 26, 2020, and a curfew has been in effect on April 3, 2020.<sup>17</sup> Apart from proper lockdown is one of the factors that might contribute to the efficiency of COVID-19 is the effective communication between the health authority and the public, including precise information and the latest situation of the disease in their country. Dr. Taweessin Visanuyothin, a spokesman for the Public Health Ministry of Thailand, did this nicely by delivering daily updated news for the public and conveying a precise message to the public on how to control the disease from spreading.<sup>18</sup> In Malaysia, the Ministry of Health did a daily press conference to update the latest situation of COVID-19 to the public. They also give sufficient up-to-date information through other media platforms, including Facebook, Telegram and the official Ministry of Health website.<sup>6</sup> Proper and transparent information could improve people's understanding of the disease and follow the recommendation by the health authority.

## Conclusions

COVID-19 causes major outbreak worldwide and causes significant morbidity and mortality to the world. Southeast Asia, situated near the epicentre of the COVID-19 original outbreak, had suffered to contain the disease. Proper preparation and support from the government, Ministry of Health, and all citizens are very important to control the disease effectively. Ministry of Health took the implementation of MCO, and action did put Malaysia as the second most effective country in Southeast Asia in managing COVID-19 infection. This data hopefully, could benefit Malaysia and all other countries to handle this COVID-19 epidemic.

**Ethical Approval:** Given

**Conflict of Interest:** The authors declare no conflict of interest

**Funding Source:** None

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