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Efficacy in Covid-19 Management: the case of ASEAN

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Abstract

Purpose - The effects of the COVID-19 pandemic have been devastating to countries around the world. Much of the problem has been the need to contain the infection via harsh social movement restrictions while having the necessary policies to cushion the ensuing economic blows that follow them. We look at ASEAN countries and assess the good practices that are associated with those which performed relatively better than the rest.

Design/methodology/approach - We use data envelopment analysis (DEA) to identify the most efficient country among the ASEAN nations in dealing with the pandemic and observe their practices with regards to the movement control metrics.

Findings - One particular country stood out in this regard, which is Singapore. We observed that its social restrictions were less stringent compared to many others yet its management of the pandemic has been highly successful despite having had the highest number of cases at one stage in 2020. This suggests massive lockdowns may not necessarily be the solution. However, the nation did place a high priority in having a high-income support, effective public campaigning and very restrictive policy on public events. In terms of originality and value, this paper uses DEA in identifying the best practice among ASEAN countries in dealing with the pandemic, both from an economic and medical perspectives.

Originality - To our best knowledge, we have not come across any papers using such approach. We hope the findings can be of some value to policymakers in designing better (public) policies when it comes to dealing with pandemics in the future.

Keywords: COVID-19, Public policy, DEA

Article Type: Research paper

1 Introduction

2020 has been the start of a very challenging period for the world as the global community was confronted by a virulent epidemic that unfortunately, continue to persist. The epidemic, dubbed as the Wuhan virus initially, the name referring to the alleged source of the outbreak, has since been officially named COVID-19 by the World Health Organization (WHO). The elevation of the virus from what was initially a health emergency outbreak to a full-fledged global pandemic was swift - it took less than 3 months, but the effects, devastating both in terms of the healthcare and economic reverberations that followed as nations battled to contain the spread via lockdowns, support spending and stimulus packages. The total cumulative number of COVID-19 infections as of 14 March 2022 stood at 456,797,217, with 6,043,094 deaths¹.

Much of 2020 have been spent not just on finding ways to combat the virus from a medical perspective but also to contain the impact and disruptions brought to the wider economy. Lockdowns, movement controls, social distancing and so on may have slowed down the rate of infectivity but these rules come with damaging effects to the livelihood of the people as many economies were virtually forced to a standstill at different intervals throughout 2020. While we have since witnessed the roll-out of vaccines (in 2021), there is still much to learn about the virus, with questions on the efficacy of managing such pandemic perhaps warranting as much attention given that this is only one of many potentially potent viruses that the world has yet to see². In essence, economic theories inform us of the adverse effects of the containment of movement to the marketplace both from the demand and supply standpoints but given the outbreak, countries and governments have little choice but to juggle the delicate balance between saving lives and managing the economy simultaneously. It was and still is

¹ <https://covid19.who.int/>

² It is estimated that there may be up to 1.6 million viruses (in animals) which we are still unaware of, with many of them having the potential to jump to humans and potentially more potent than COVID-19. See Smith (2020).

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3 challenging, given the many mass protests that have erupted with every lockdown
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5 announcements, this especially so in many Western economies. The protests, sometimes
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7 violent, have been fuelled by public distrust of governments and anger from the people as a
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9 result of having their personal freedom curtailed. In contrast, many countries in Asia, both
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11 developed and developing, saw lesser resistance, and to some extent, lower levels of infections
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13 as well³. In the case Southeast Asia, the number of cases and deaths were also relatively lower
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15 especially during the earlier stages of the pandemic⁴. These countries had implemented swift
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17 and stringent measures, while also supporting them with extensive fiscal outlays.
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24 Nonetheless, we have also seen that the situation can be rather dynamic and fluid as well –
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26 changes in the developments of the pandemic (i.e., in terms of the number of cases) can turn
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28 quickly – for e.g., Singapore during the second quarter of 2020 (April to July) and Malaysia,
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30 towards the later part (around the fourth quarter) of 2020. In both instances, the countries
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32 witnessed a sharp spike in cases following an otherwise much lower infection rates earlier. Of
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34 course, in general, the infection rates/number of cases are due to many factors - not just the
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36 number of tests being conducted but also other factors like premature end to lockdowns,
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38 implementation (and policing) of rules/procedures, the public's adherence to them, virus
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40 mutations and so on – these obviously complicate things. Indeed, the management of the
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42 pandemic both in terms of safeguarding the healthcare system and managing the livelihood of
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44 the people has proven to be an arduous affair. Granted that public resistance has been less
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46 potent among the Southeast Asian countries, the fiscal limitations in many of the poorer
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55 ³ Alfano & Ercolano (2020) found that initiating a lockdown is indeed effective in reducing the number of new
56 cases when comparing countries which opted for it as opposed to those which did not. In fact, the impact is
57 especially true in the first 10 days while its efficacy is sustained even after 20 days.

58 ⁴ That said, the number of cases correlates to the testing intensity so the official number of cases reported may be
59 misleading in countries with limited testing capacity. Further, given the fact that older people are more susceptible
60 (and likely succumb) to the virus, the number of deaths statistic may also be bias against aging countries, this
likely to be the case for developed countries like UK.

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3 members remain a challenge especially in terms of healthcare spending. For example, the total
4 healthcare & income support spending per capita for Myanmar and Laos were only US\$0.51
5 and US\$1.10 respectively! (<https://covid19policy.adb.org/policy-measures>)⁵
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12 The objective of this paper is to compare the efficacy of ASEAN countries in managing the
13 COVID-19 pandemic both in terms of containing the disease and also in managing the
14 economy. In the case of the former, the achievement metric is in terms of the infection
15 recoveries while for the latter, the gross domestic product (GDP) for the year 2020. Employing
16 a data envelopment analysis approach, we conducted a relative performance evaluation to
17 ascertain the best performer from an input-output analysis with the output being the two above-
18 mentioned metrics. Next, we assess the strategies that were employed by the best performed
19 (most efficient) nation(s), this to highlight the best practise (policies) for the less efficient ones
20 to benchmark against.
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35 **2 Related Literature on COVID-19 in ASEAN**

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37 Chong *et al* (2021) assess the economic impact of COVID-19 among ASEAN countries at the
38 initial phase of the pandemic, i.e., in 2020. Singapore, together with Malaysia, Thailand and
39 Philippines were the members that had experienced the highest economic contraction from the
40 onset of the pandemic. Their paper also highlighted that the expansionary fiscal policy (e.g.,
41 large-scale tax cuts) pursued by some of the members were insufficient to overcome the
42 negative impact brought upon by the pandemic and the resulting lockdowns. They also
43 highlighted the cross-country transmission of unemployment issue in ASEAN, for e.g.,
44 economic contraction of Singapore affecting the unemployment of other countries that export
45 labour to it. Meanwhile, Lee *et al* (2020), argued that those which implemented stringent
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⁵ Based on data from this website, updated to 8 February 2021.

measures (e.g., Malaysia, Singapore, Philippines) for a longer period coped better with the pandemic but suffered economically especially in terms of their consumption.

In terms of containing the pandemic, it is crucial to manage public perceptions and sentiments carefully so that greater compliance (for e.g., mask wearing and social distancing willingness) can be elicited from the public as their trust can be gained while also avoiding unnecessary fear and panic. Singapore's Prime Minister Lee Hsien Loong and Vietnam's Deputy Prime Minister Vu Duc Dam were exceptional in their communication and transparency (Djalante *et al*, 2020). Chua *et al* (2020) echoed this, citing consistent and transparent information relayed by key figures being paramount in the public's acceptance of policy measures and cooperation in containment efforts – this very much in the case Singapore. Lee *et al* (2020) pointed out the following effective policy responses in ASEAN: quick border shutdowns, previous related lessons like SARS (i.e., Singapore, Vietnam), having robust public healthcare system (i.e., Singapore, Thailand, Malaysia), clear government messaging, effective local quarantine and testing/tracing systems.

3 Data and Methodology

3.1 Data

The data for this paper is taken from several sources. The figures for the number of cases, the number of recoveries, the tests per million and forecasted GDP figures (for both 2019 and 2020) are sourced from the Center for Strategic and International Studies, a bipartisan, non-profit policy research organisation in the US (<https://www.csis.org/programs/southeast-asia-program/southeast-asia-covid-19-tracker-0>). Meanwhile, the data for the stimulus package (as percentage of 2019 and per capita) are taken from Asia Development Bank (<https://covid19policy.adb.org/policy-measures>). Table 1 presents the descriptive statistics.

Further, we also use data from Asia Development Bank and the internet website, Our World in Data (<https://ourworldindata.org/about>) in our later discussions on the countries' various measures of lockdown.

Table 1: Descriptive Statistics

	Number of cases*	Number of recoveries*	Stimulus Package (% of 2019 GDP)	Stimulus Package per capita (US\$)	Forecasted GDP (2020)*	Tests per million*
Indonesia	1012350	820356	10.9	426.18	0.3	0.02195
Philippines	516166	475423	5.7	213.74	-3.6	0.07277
Vietnam	1551	1430	10.1	279.57	2.7	0.01539
Thailand	14646	10892	16	1207.77	-7.7	0.01854
Myanmar	137957	122116	0.1	1.83	1.8	0.03155
Malaysia	190434	149160	22.1	2877.96	-3.8	0.14203
Cambodia	460	412	8.3	134.05	-1.6	0.00937
Laos	44	41	0	4.23	0.7	0.01488
Singapore	59366	59066	26.2	15629.1	-3.5	1.12533
Timor Leste	67	50	8.65	196.42	n/a	0.01419
Brunei	176	169	2.7	734.21	1.3	0.21024

Note: * Data source from <https://www.csis.org/programs/southeast-asia-program/southeast-asia-covid-19-tracker-0> ⁶

** Data source from <https://covid19policy.adb.org/policy-measures> ⁷

3.2 Methodology

3.2.1 Data Envelopment Analysis

Data Envelopment Analysis (DEA), originally used by Charnes, Cooper and Rhodes (1978), is essentially a mathematical-based methodology that is used to ascertain the efficiency of performance among a group of homogenous (or assumed) decision-making units (DMUs). The methodology is basically a mathematical programming production frontier, and in its approach, relative efficiency is defined as a DMU's performance measured in relation to a constructed "efficient" frontier. The frontier represents essentially the set of "best practice observations" (efficient coordinates) in the sample of DMUs. While Farrell (1957) decomposes the cost

⁶ Accessed 27 January 2021

⁷ Accessed 28 January 2021. The data on the stimulus packages were updated until 25 January 2021.

efficiency analysis of DEA into two parts, i.e., technical efficiency and allocative efficiency, our DEA analysis focuses on the technical efficiency (TE).⁸ Further, our computation of the TE scores takes on an output orientation given that we intend to measure countries' performance in handling the pandemic, i.e., to what extent are the outcomes (outputs) of the superior DMU(s) relative to others' outcomes.⁹

In terms of our DEA models, we selected 4 models to capture the performance of countries in dealing with the pandemic from different perspectives (see Table 2). Firstly, we look at how countries address the pandemic from the medical angle, i.e., how their policies and management have translated to higher recovery rates. Secondly, we also wanted to assess the extent to which the handling has led to quicker economic recoveries as well. While models 1 and 2 look at the former, models 3 and 4 will assess both the former and latter simultaneously. Models 1 and 2 are similar except that the latter had one less country – we do this for consistency purposes as models 3 and 4 also had one less country¹⁰.

Table 2: DEA Models

No.	Type of DEA Analysis	Outputs	Inputs	No. of observations (countries)	Time-period(s)
1.	Output-oriented Multi-stage DEA	Total Recoveries	Total cases, Test per population	11	2020
2.	Output-oriented	Total Recoveries	Total cases, Test per population	10	2020

⁸ The two parts refer to the technical and price (allocative) efficiency respectively with the former about the ability to produce maximum output from a fixed number of inputs while the latter, the DMU's capability to optimize on its inputs' quantity usage given their prices and technological levels.

⁹ In the context of firms as DMUs, Coelli (n.d.) argue that the decision between selecting an input or an output orientation would depend on whether it is in fact, the inputs or the outputs that the DMUs have greater control over. In our analysis, both the inputs (tests per million, quantum of stimulus package) and outputs (GDP) selected in our model can, to some extent, be controlled by the countries.

¹⁰ There was no data provided for Timor Lester's projected 2020 GDP figure in our source, <https://www.csis.org/programs/southeast-asia-program/southeast-asia-covid-19-tracker-0>

3.	Multi-stage DEA Output- oriented Multi-stage DEA	Total Recoveries, 2020 GDP*	Total cases, Stimulus package as a percentage of 2019 GDP	10	2020
4.	Output- oriented Multi-stage DEA	Total Recoveries, Difference between 2020 GDP and 2019 GDP*	Total cases, Stimulus package per capita	10	2020

*Projected figures

4 Results

From our DEA technical analysis, we find that Singapore has been by far the most efficient performer among ASEAN countries. Table 3 presents the TE results for all four DEA models pursued. Singapore consistently operated on the efficient frontier (i.e., 100% TE score in all four models), with a perfect 100% mean score. While there are other countries that have also achieved 100% TE scores as well, we focused solely on one best nation because we are mindful of the limited observations in our analysis - small samples in DEA analysis could result in too many entities being classified as efficient¹¹. As such, we acknowledge that the distinction between efficient and otherwise must be made even more pronounced in our analysis hence our identification of only one clear leader, i.e., Singapore. Further, we are also keenly aware of the non-stochasticity of DEA in that it does not recognise statistical errors/noises in its ranking exercise (it assumes homogeneity among the DMUs) thus undermining its accuracy - it is highly sensitive towards the data that is used. As such, we also look at the other aspects in the countries' pandemic management to make further sense of the best practices (policies).

¹¹ See Cubbin & Tzanidakis (1998).

Table 3: DEA Technical Efficiency Scores among ASEAN countries

No.	Countries	Technical Efficiency				
		Model 1	Model 2	Model 3	Model 4	Mean
1	Indonesia	1.000 (1)	1.000 (1)	0.868 (8)	0.880 (8)	0.937
2	Philippines	1.000 (1)	1.000 (1)	0.987 (3)	1.000 (1)	0.997
3	Vietnam	0.961 (5)	0.961 (5)	0.929 (6)	0.949 (6)	0.950
4	Thailand	0.804 (10)	0.804 (10)	0.747 (10)	0.788 (10)	0.786
5	Myanmar	0.961 (5)	0.961 (5)	0.950 (5)	1.000 (1)	0.968
6	Malaysia	0.848 (9)	0.848 (9)	0.826 (9)	0.847 (9)	0.842
7	Cambodia	0.900 (8)	0.900 (8)	0.905 (7)	0.913 (7)	0.904
8	Laos	0.937 (7)	0.937 (7)	1.000 (1)	1.000 (1)	0.968
9	Singapore	1.000 (1)	1.000 (1)	1.000 (1)	1.000 (1)	1.000
10	Timor Leste	0.750 (11)	-	-	-	0.750
11	Brunei	0.965 (4)	0.965 (4)	0.982 (4)	0.975 (5)	0.972
	Mean	0.920	0.938	0.919	0.935	

Note: Parentheses in the columns 3 to 6 denote ranking

Avkivran (1999) discusses the value of identifying a global leader in DEA, i.e., the DMU that appears the most often as a peer in the peer count tabulations¹². Our findings show Singapore appearing the most often as a peer over the four DEA TE models (see Table 4) and is also the country with the highest mean TE scores across the four models (see Table 3). It recorded a total of 15 peer references, significantly higher than those which had recorded 100% of TE in at least one of the 4 models. These findings indicate that Singapore has been most efficient in handling the COVID-19 pandemic and hence useful to serve as the benchmark for the rest.

Table 4: Peer Counts in the 4 DEA models

No.	Countries	Technical Efficiency				
		Model 1	Model 2	Model 3	Model 4	Total
1	Indonesia	0	0	0	0	0
2	Philippines	4	4	1	2	11
3	Vietnam	0	0	1	0	1
4	Thailand	0	0	0	1	1
5	Myanmar	0	0	0	0	0
6	Malaysia	0	0	0	0	0
7	Cambodia	4	4	0	2	10

¹² The peer count in DEA refers to the number of times an efficient entity is being benchmarked by the other inefficient entities in the analysis.

8	Laos	1	1	2	2	6
9	Singapore	5	5	3	2	15
10	Timor Leste	0	-	-	-	-
11	Brunei	0	0	0	2	2

In terms of the stimulus packages, Singapore, by far had the largest stimulus package – it spent around US\$89 billion despite being one of the smallest nations in the group. Per capita-wise, it spent more than five times the expenditure of Malaysia, the nation with the second highest expenditure – it spent US\$15,629.10 for each citizen as compared to Malaysia, at US\$2,877.96. Given the adverse economic shocks from multiple lockdowns throughout 2020 in many of the countries, the need for a big stimulus response was warranted to stem the impact of a fall not just in private consumption but also in firm spending and exports, both of which impacted consumer spending and employment as well. This is more so for those highly dependent on trade like Singapore, Thailand, Malaysia and Vietnam. Meanwhile, in terms of healthcare spending and income support, Singapore also had the highest spending – it spent around US\$51 billion.

Table 5: Total Stimulus Spending by ASEAN countries

Countries	Total Stimulus (in US\$ millions)	Stimulus per capita	Total Healthcare & Income Support Spending, in US\$	Total Healthcare & Income Support Spending, in US\$ Per capita
1 Indonesia	115,334.32	426.18	37,930,198,453	140.1586
2 Philippines	35,971.40	332.71	27,853,077,236	257.6213
3 Vietnam	26,967.94	279.57	12,902,948,139	133.7617
4 Thailand	84,091.79	1,207.77	43,603,149,053	626.2511
5 Myanmar	98.64	1.83	27,318,117	0.506814
6 Malaysia	91,950.28	2,877.96	26,320,615,485	823.8113
7 Cambodia	2,210.00	134.05	210,000,000	12.73778
8 Laos	30.35	4.23	7,869,126	1.096751
9 Singapore	89,141.77	15,629.10	51,589,128,133	9045.049
10 Timor Leste	254	196.42	150,000,000	115.9961
11 Brunei	318.12	734.21	n/a	n/a

Note: Data sourced (and tabulated using the data) from <https://covid19policy.adb.org/policy-measures> ¹³.

In terms of the lockdowns and movement restrictions, we look at the Stringency Index (SI) among the countries – the index is essentially derived from 13 areas, namely, school closure, workplace closure, cancellation of public events, restrictions on gatherings (size); public transportation closure, stay home requirements, internal movement restrictions, international travel restrictions, public information campaigns, testing policy, contract tracing, face coverings requirements and vaccination¹⁴. From the data, we calculate the mean value of the SI for the year 2020 (see Table 6). Interestingly, Singapore is ranked 6th in terms of the mean SI (for 2020), much lower than many other countries which performed poorer in terms of our DEA analysis. In fact, countries like Philippines, Vietnam, and Indonesia recorded higher SI than Singapore but performed poorer than Singapore in our TE analysis.

Table 6: Stringency Index

No.	Countries	Stringency Index (2020)	Stringency Index (1 st quarter)*	Stringency Index (2 nd quarter)*	Stringency Index (3 rd quarter)*	Stringency Index (4 th quarter)*	% of Q4 Stringency Index over 2020 index*
1	Indonesia	53.99 (5)	25.32	69.93	62.08	58.76	108.83
2	Philippines	66.45 (1)	30.76	91.78	74.57	67.87	102.14
3	Vietnam	56.92 (3)	32.19	74.50	67.83	51.62	90.69
4	Thailand	46.00 (7)	12.23	71.46	50.15	50.08	108.87
5	Myanmar	62.44 (2)	11.07	81.13	78.53	78.67	125.99
6	Malaysia	54.18 (4)	24.41	68.46	53.94	69.77	128.77
7	Cambodia	37.33 (10)	10.87	52.92	41.14	44.27	118.59
8	Laos	34.88 (9)	6.43	69.36	30.81	32.98	94.55
9	Singapore	48.76 (6)	27.96	51.99	50.93	46.22	94.79
10	Timor Leste	31.62 (11)	11.17	56.82	29.63	28.91	91.43
11	Brunei	38.32 (8)	23.04	53.67	41.37	35.19	91.83

Source: <https://ourworldindata.org/grapher/covid-stringency-index>

*Authors' own tabulation from the above data source.

¹³ The figures in Table 5 are quoted (and tabulated using the data) in this website, the data (as per those) updated as of 8 February 2021. We accessed the site on 17 February 2021.

¹⁴ From the website, <https://ourworldindata.org/grapher/covid-stringency-index>, as of February 2021.

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5 Meanwhile, Table 7 presents 11 of those 13 key areas which are used to calculate the SI with
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7 the two omitted areas being ‘testing policy’ and ‘vaccination’. The omission of ‘vaccination’
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9 is because it only started in 2021 (after our period of analysis, i.e., 2020) while in the case of
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11 ‘the number of tests’, it is already included in our DEA analysis. In terms of these 11 key areas,
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13 we identified a particular pattern in Singapore’s case. While Singapore’s overall SI is relatively
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15 lower compared to the rest, there are however, three areas in which it has the highest index
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17 value, namely ‘average income support’, ‘public campaign’ and ‘cancellation of public events’
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19 (see Table 7).
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Table 7: Indices in the Stringency Index

No.	Countries	Contact Tracing	Average Income support Index	School Closure Index	Work place closure Index	Public Transportation Index	Public Campaign Index	Cancellation of Public Events	Restrictions on gatherings	internal movement restrictions	face coverings requirements	international travel restrictions
1	Indonesia	53.99	0.38	2.26	1.76	0.46	1.92	1.56	2.94	0.98	2.95	2.93
2	Philippines	66.45	0.58	2.43	1.79	1.34	1.87	1.70	3.11	1.00	1.32	2.71
3	Vietnam	56.92	0.73	1.91	1.77	0.94	1.85	1.27	2.47	1.22	1.71	3.08
4	Thailand	46.00	1.30	1.39	1.16	0.54	1.64	1.05	1.81	1.18	2.20	2.57
5	Myanmar	62.44	0.29	2.24	1.98	1.09	1.63	1.61	2.78	1.50	2.55	2.62
6	Malaysia	54.18	0.74	2.00	1.46	0.18	1.92	1.54	1.98	1.22	1.87	2.81
7	Cambodia	37.33	0.68	1.72	1.58	0.00	1.54	0.70	2.09	0.04	1.01	1.64
8	Laos	34.88	0.76	1.07	1.32	0.27	1.51	0.89	0.81	0.27	3.80	2.45
9	Singapore	48.76	1.35	1.03	1.56	0.00	1.99	1.70	2.08	0.41	2.89	2.88
10	Timor Leste	31.62	1.06	1.56	0.33	0.18	1.59	0.33	0.68	0.00	1.64	3.11
11	Brunei	38.32	0.50	1.41	0.37	0.00	1.97	0.98	2.02	0.29	1.45	2.91

Source: <https://ourworldindata.org/grapher/covid-stringency-index>

Note: The mean data are from the period 1 January to 31 December 2020 (tabulated by the authors) although the daily figures for some countries are not available especially in the early months of the 2020.

5 Policy Implications

From our DEA findings, Singapore's performance is clearly superior to the rest in ASEAN. As such, we argue that its COVID-19 management should be the benchmark for the others, not just in terms of managing the COVID-19 pandemic but also in combating future epidemic threats. Given that our models involve the process of transforming the number of COVID-19 cases and stimulus packages to the number of recoveries and GDP outcomes (projected), it appears that Singapore's pandemic management is effective both from the medical and economic perspectives compared to its ASEAN neighbours.

In general, all the countries resorted to lockdowns and mobility restrictions to curb the spread of the virus and unsurprisingly, the economic effects were telling, with their quarterly GDP performances suffering massive contractions especially in the second quarter of 2020 since many had major lockdowns then¹⁵. In any event, we argue that while control movements would curb infectivity rates, there are economic issues to be considered. The effective management of the people's day-to-day lives is also important in terms of raising their morale in fighting the virus – perhaps even more importantly, this to instil confidence to the people and businesses that the government has an elaborate and effective plan in dealing with the situation. Ferlito (2020) argued that the strictness of the measures in place cannot serve as an explanation for a

¹⁵ We are mindful that lockdowns are not necessarily the same across the ASEAN countries. For e.g., Singapore's lockdown, named circuit breaker, saw different phases in 2020 but essentially included the closure of workplaces, schools, barring of dine-ins at food establishments and so on. Measures were additionally tightened in later phases, this further curtailing the allowed list of 'essential services'. Malaysia meanwhile, initiated the Movement Control Order (MCO), which saw the closure of many sectors except those deemed as essential but also the prohibition of inter-district and inter-state travelling. An Enhanced Movement Control Order (EMCO) was nonetheless enforced in areas deemed as large clusters, these areas being cordoned off and police patrolled. For Vietnam, lockdowns in the initial phase were targeted at areas/provinces with clusters but eventually also led to national-level lockdowns. As for Indonesia, lockdowns were more local-levelled, i.e., implementations at city level, although Jakarta was the first to initiate the "large-scale social restrictions" lockdown. Recognising this issue of heterogeneity, we analyse and discuss the lockdowns and social restrictions issue using the Stringency Index, which uses a selected number of common metrics applied to all the countries.

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3 low level of deaths or cases *per se*. He asserted that studies have shown that harsh lockdowns
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5 are not effective in containing the virus but rather plunge people into poverty and damage
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7 investor confidence (“Abandon harsh, costly lockdowns”, 2021). While the overall pattern
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9 linking SI to our DEA analysis is not entirely obvious, poorer performed countries tend to
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11 record a subsequent upswing in their SI (quarterly), presumably due to resurgence of cases.
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13 However, Singapore’s experience suggest that swift restrictions coupled with good
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15 management of the pandemic resulted in quicker reopening of markets and this has proven
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17 crucial to Singapore’s success. Its fourth quarter SI as a percentage of its overall 2020 SI is
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19 among the lowest (see Table 6) despite it having the highest number of infections in Southeast
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21 Asia at one point (i.e., in May 2020) – this indicating its much-improved situation by then¹⁶.
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23 Further, even during its peak period (around the middle of 2020), its SI for the second quarter
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25 was the lowest in the region. Even in the third quarter, its SI was only the 6th highest among
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27 the 11 nations. This lends credence to the argument that extreme controls and lockdowns may
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29 not be an ideal proposition in dealing with a pandemic. Nonetheless, Singapore’s SI did rise
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31 considerably in the second quarter of 2020 (and stay close to that level in the third quarter) – a
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33 response to the huge spike of cases then. Undeniably, lockdowns would be crucial and expected
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35 then, a response to swiftly curtail the increase in new cases, a notion that is supported by many
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37 studies (e.g., Alfano & Ercolano, 2020). Nonetheless, the fact that even at its height,
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39 Singapore’s SI was still lower than many of its peers suggests that it is possible to deal with
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41 the problem without resorting to overzealous containment strategies.
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51 That said, while Singapore’s overall SI is relatively lower compared to many in the sample,
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53 there are three areas in which it has the highest index value, i.e., ‘average income support’,
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55 ‘public campaign’ and ‘cancellation of public events’. In the case of ‘income support’, it comes
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16 <https://www.aa.com.tr/en/asia-pacific/singapore-s-covid-19-cases-highest-in-southeast-asia/1830924>

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3 as no surprise as sufficient income support is needed to ensure that people's livelihood is
4 addressed and also businesses, able to cope with the adverse supply shocks that came with the
5 internal movement restrictions and global travel lockdowns¹⁷. Such move ensures the
6 containment of some of the aggregate demand and aggregate supply contractions. Next,
7 effective 'public campaigning' is crucial in that it is imperative both to inform and to educate
8 the people on the actual situation on the ground and highlight the importance of implementing
9 the necessary social practices¹⁸. As far as community engagement is concerned, government
10 messages in the case of Singapore have consistently emphasised on individual responsibility
11 (Han *et al*, 2020). Finally, 'cancellation of public events' is paramount given that social
12 distancing may be difficult to be maintained during big public events like performances and so
13 on. In contrast, Singapore's school and workplace closure index is fairly low compared to the
14 rest indicating the importance placed upon maintaining the institutions and functioning of work
15 and study in society. Haug *et al* (2020) argued that governments (and other stakeholders)
16 should pursue less intrusive non-pharmaceutical interventions, NPIs (for e.g., governmental
17 support to vulnerable populations and risk-communication strategies), before moving on to
18 more intrusive ones (i.e., closure of business, schools, national lockdown and so on), this (the
19 latter) only if the infection surges¹⁹. For example, only after months of public counselling (on
20 the need of wearing masks only if unwell) did the Singapore government declared the wearing

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¹⁷ Singapore's income support includes *the care and support package* schemes (this to provide support for households via direct cash pay outs, grants, and vouchers to all citizens in addition to further additional payments for the lower-income Singaporeans and the unemployed group), and the business-targeted stabilization *and support package* scheme (which wage subsidies, enhanced financing schemes, additional support for industries directly affected and for the self-employed). In terms of the latter, it is amongst a host of other economic resilience measures under income support. See <https://covid19policy.adb.org/policy-measures> for more.

¹⁸ Carmelo Ferlito, the chief executive of the *Center of Market Studies*, a think tank based in Kuala Lumpur, suggested instead for better data collection to be conducted and subsequently released, this allowing the people to make their more own decisions (informed decisions taking into account the risks) surrounding their movements and exposure. This, coupled with better enforcement of existing rules may be a better strategy in containing the pandemic. See <https://www.freemalaysiatoday.com/category/nation/2021/01/24/abandon-harsh-costly-lockdowns-says-economist/>

¹⁹ Haug *et al*'s paper uses hierarchically coded dataset of 6,068 NPIs that were implemented in the period of March to April 2020 in 56 countries including the US.

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3 of mask by anyone outside their homes as mandatory - they also did so with the provision of
4 reusable cloth masks to the entire population (Han *et al*, 2020) and this via community centers
5 and resident committee centers, aided by volunteers (Das & Zhang, 2020). In any case, Haug
6 *et al*'s argument is that the less drastic options work better in that the people are more likely to
7 comply with them. In this regard, Singapore's strategy in managing the pandemic is somewhat
8 in line with Haug *et al*'s assertions.
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19 Interestingly, Brauner *et al* (2020), using cross-country modelling (of chronological data on
20 the implementation of several interventions) found that while banning gatherings was effective
21 in reducing transmission at the onset of the pandemic, closing both schools and universities
22 was even more effective. Nonetheless, it is worth pointing out that Singapore's school closure
23 index was significantly higher during (and only during) the critical stage of the pandemic (i.e.,
24 the period in which the country saw a dramatic rise in daily cases) – its school closure index
25 was significantly higher for a short period in 2020, i.e., from early April to the end of May. It
26 is also important to emphasise that while the critical period for Singapore lasted up to August
27 of 2020, its school closure index was nonetheless, already relaxed after the 1st of June 2020. In
28 any event, these productive activities (school and work) are the cornerstone of a well-
29 functioning society, the former in terms of knowledge building while the latter, income
30 generation – they are the keys to the workings of a well-running economy and its longer run
31 potential. As such, it is crucial that they are not shut down for too long and it appears so for
32 Singapore, at least during the pandemic's first year (i.e., 2020).
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54 That said, the lockdowns (i.e., Circuit Breakers) initiated in Singapore has undoubtedly
55 impacted households. Disruptions in social interactions, relative visitations and
56 sporting/exercise activities were the top three everyday life matters affected in a survey by Daly
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3 *et al* (2021a) while household harmony, children's education and child-care were the least
4 affected²⁰. Interestingly, the impact to household income was only ranked 4th in the survey.
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Meanwhile, the majority of respondents in a study by Daly *et al* (2021b) agreed that the Singapore government did well in managing the pandemic during the circuit breaker and indicated high levels of willingness to continue with some of the measures implemented. In fact, the paper found a majority of the respondents felt that the sacrifices (e.g., on personal mobility, working life, and privacy) were justified for the overall well-being of all²¹.

5 Implications for research, practice and/or society

Overall, our paper, despite their limitations and their focus on the earlier phase of the pandemic can still help shed light on the delicate issue of balancing between the demands of public health interest and mitigating the economic fallout as a result. Economic theory would inform us that social restrictions would harm the economy (since GDP tabulations are transaction-based) so it is imperative that governments spend sufficiently in such extreme times. This underscores the textbook theories taught in classrooms in that fiscal policy is the key tool during an extreme economic situation, this clearly so as well during COVID-19 pandemic. In the case of Singapore, not only did the country embark on the highest stimulus spending (its US\$9045.049 per citizen was almost 11 times more than the next closest nation, Malaysia) compared to its ASEAN neighbours, their spending were also concentrated more at specific areas, with close

²⁰ The Singapore daily *The Straits Times* conducted a survey a year after the 2020 Circuit Breaker found people socialising less and their social circles reduced. Further, 1 in 3 reported a decline in their mental wellbeing. Meanwhile, 52% of those employed felt an increased in their workload, this possibly due to the lines between working and otherwise being blurred by having to work from home (Goh, 2021). The contraction in social interaction and exercising activities resulted in older citizens especially those living alone being susceptible to social isolation although the government introduced initiatives to improve their digital skills to better cope with the situation (Yip *et al*, 2021).

²¹ Such attitude has boded well for Singapore's fight against COVID-19 - Yip *et al* (2021) identified civic-mindedness and responsibility (collective) as one of the key areas that can make a difference in a community's preparedness in dealing with infectious diseases.

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3 to 60% of their stimulus spending being allocated to “total healthcare & income support”.²² The
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5 fact that Malaysia and Thailand did not fare well in our DEA analysis (both ranked at the
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7 bottom) indicate that fiscal spending (their stimulus per capita are highest next to Singapore)
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9 alone is insufficient – efficacy in the other public policies is also crucial. In this regard, policies
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11 on social restrictions and lockdowns must be done with care and restraint – this not only to
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13 minimise the disruption/impact to people’s lives but also to inspire confidence among the
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15 public and businesses. We argue that particular attention should also be directed at the extent
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17 of the restrictions placed on key institutions – this to safeguard the long-run supply side of the
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19 economy especially since such pandemic is unlikely a short-lived phenomenon.
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26 **6 Concluding Remarks**

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28 The COVID-19 pandemic has been a major predicament globally, its impact wreaking havoc
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30 to economies, disrupting livelihoods and the general way in which how we have been living
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32 our lives. Many countries quickly resorted to swift and major lockdowns curtailing social
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34 movements and people’s freedom. In some cases, draconian measures were resorted even.
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36 Nonetheless, unlike the previous pandemics (for e.g., SRAS), the containment has proven to
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38 be much more challenging in the case of COVID-19 thus lockdowns became a regular affair
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40 throughout 2020 (and into 2021). While such moves were deemed as necessary in curtailing
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42 the spread and more importantly, to avoid inundating the healthcare system with record number
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44 of cases, there were nonetheless, concerns on the detrimental economic effects. The balancing
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46 of the two issues has proven to be both delicate and divisive, with some even arguing that the
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48 effects of lockdowns do little in curbing the infectivity rates but instead paralysing the
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57 ²² Singapore’s key fiscal measures target’s focus was narrower than almost all the other ASEAN countries in the
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59 case of both the support for households and businesses. In terms of direct/indirect support for households, it
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61 focused only on direct income support/cash transfer, utility subsidization and individual loan moratoriums while
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63 for businesses, it focused on differed tax payment, sector-based support and loans support/ interest rate subsidy
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65 to SMEs. See Lee *et al* (2020) for more details.

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3 economy. We look at the experience of ASEAN countries and identify the best practices of
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5 managing the pandemic – we used DEA to ascertain the most efficient nation and went through
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7 some of its practices specifically with regards to some movement control metrics. These
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9 metrics are based on several areas that make up the SI. The success of Singapore (relative to
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11 the other ASEAN countries) suggests that overly strict movement controls may not necessarily
12
13 be the key in managing a pandemic as the economic trade-off may be too costly. The lessons
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15 learned from countries like Singapore suggest that moderate movement controls (i.e., moderate
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17 SI) may be more effective although particular restrictions should be placed on public
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19 campaigning and restrictions to public events. This echoes Brauner *et al* (2020) in that the use
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21 of effective interventions can avoid unnecessary stay-at-home orders since the net effects of
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23 the latter are minimal under such arrangements. This may lend support to the argument of
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25 overly zealous lockdowns being counter-productive in the successful management of the
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27 pandemic.
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