



# Understanding the impact of the coronavirus outbreak on the economic integration of ASEAN countries

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## ARTICLE INFO

### JEL classification:

F15  
F23  
D85

### Keywords:

Firm-level data  
Coronavirus pandemic  
Market integration  
Networks

## ABSTRACT

This study examines the impact of the coronavirus pandemic on the economic integration of the ASEAN-6 region. The study finds that the coronavirus pandemic's impact can be easily traced using stringency, bilateral exports, and tourist arrivals, indicating a significant implication for the economic integration process. The firm-level analysis suggests that though the coronavirus outbreak's impact has caused uniformly to firms, the effect varies across ASEAN-6 nations. The pandemic strongly impacts large firms.

## 1. Introduction

The coronavirus pandemic has engulfed the global economy for more than two years. From the economy side, the coronavirus pandemic impacted the economies through various channels. Some of these channels are the rise in unemployment and poverty, travel restrictions, an increase in the trade deficit, and inflation. The global economy has reached a point where economies are staring at an economic crisis or civil war. The outlook of those economies is a cause of concerns that are heavily dependent on exports, travel, and leisure. In this context, we present a detailed analysis of the ASEAN (Association of Southeast Asian Nations) for two reasons. First, ASEAN comprises ten nations, including Thailand, Indonesia, Malaysia, Vietnam, Singapore, and the Philippines. These economies are strongly interlinked and depend on exports, travel, and tourism. Second, ASEAN is the fifth largest economy in the world, with a combined income of 3.2 trillion USD, and is expected to become the fourth largest by 2030. The region also has 61% of its population under the age of 35 years.<sup>1</sup> Due to their high economic integration, the coronavirus pandemic has adversely impacted these nations' well-being. There is a need to study the impact of the coronavirus pandemic on these

nations policymakers and researchers. This study is an attempt in this direction.

The intra-ASEAN trade is another factor that plays a critical role in driving the economies in this region. In 2019, the intra-ASEAN trade and foreign direct investment shares had 23% and 16% (ASEAN, 2019). Another critical driving factor is tourism due to cultural similarities, which has a share of 12% of GDP in 2018. The Regional Comprehensive Economic Partnership (RCEP) Agreement has also sought the global community's attention as it is expected to cover 30% of the global income and population (Shimizu, 2021). ASEAN is also leaping to get attention for its effort to address the new challenges of the fourth industrial revolution (Enzmann and Moesli, 2022). The coronavirus (COVID-19) pandemic has adversely impacted the ASEAN region's growth momentum. There are several factors responsible for this crisis. First is the geographical proximity to China. The second is insufficient health infrastructure (OECD, 2020). Third, tourism-dependent economies. However, the COVID-19 pandemic has put enormous pressure on the movement of goods and services. For instance, the pandemic has restricted the flow of manual and domestic workers, impacting the growth of manufacturing, tourism, and ancillary sectors. The ASEAN

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<sup>1</sup> <https://www.weforum.org/agenda/2022/01/asean-is-poised-for-post-pandemic-inclusive-growth-and-prosperity-heres-why/> (accessed on 16 June 2022).

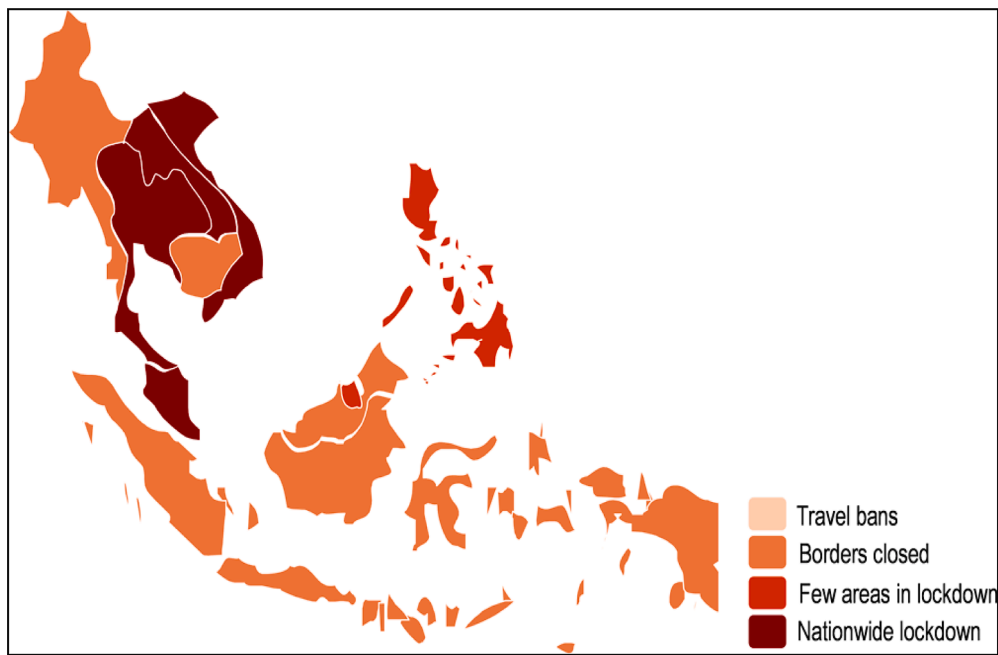


Fig. 1. ASEAN's response to the coronavirus outbreak

Source: OECD: COVID-19 crisis response in ASEAN Member States Link: <http://www.oecd.org/coronavirus/policy-responses/covid-19-crisis-response-in-asean-member-states-02f828a2/> (Accessed on October 23, 2020).

Comprehensive Recovery Framework (ACRF) was implemented to overcome the pandemic shocks at the regional level. The ACRF fosters regional economic integration through an appropriate response system for needy sectors and sets the broad strategy for a robust recovery. The recovery efforts also included the 'Broad Strategies' focusing on better health services, poverty alleviation, upskilling for employment, and promotion of digital learning (ASEAN, 2020). The promotion of regional cooperation through intra-ASEAN trade also became a key focus. Intra-ASEAN trade and investment, boosting of regional supply chains, rationalization of non-tariff barriers, and digitalization of trade accounts are some of the measures which are part of the mega-regional recovery plan of ACRF. Coming to tourism, which is a pivotal contributor to the region's growth and prosperity, intra-ASEAN tourism contributed 40% in 2019. However, the ASEAN region is still facing challenges in implementing regional economic agreements and the revival of small and medium enterprises. The digitalization efforts and clean energy transition are other challenges that require policy and regulatory attention (Narjoko, 2020).

An overview suggests that the issue of economic integration during the pandemic has not received much attention, and there is a void as far as comprehensive understanding is concerned. Few relevant studies include Djalante et al., (2020), Bakar et al. (2021), La and Miranti (2021), Chong et al. (2021), Purnomo et al. (2022), Lean et al. (2022), Katsumata (2022), Enzmann and Moesli (2022). The common understanding suggests the comprehensive cooperation framework and regional resilience of ASEAN. These studies also highlight the response and effectiveness of different relief measures but failed to provide a deep understanding of the impact of the pandemic on economic integration and how member nations responded during the pandemic. In this light, the main aim of this study is to draw the new contours of regional economic integration in the Southeast Asia region in light of the coronavirus pandemic. As of February 28, 2022, Indonesia and the Philippines had the maximum casualties, followed by Vietnam, Thailand, and Malaysia.<sup>2</sup> As an immediate curtailment measure, most

countries in the ASEAN-6 group imposed travel restrictions, lockdowns, and social distancing measures in March 2020 and took steps to open up their economies gradually. ASEAN-6 nations also announced a special stimulus package to thwart the persistence of economic vulnerabilities. Fig. 1 shows ASEAN's response to the coronavirus outbreak.

One of the main features of this study is to provide an in-depth analysis of major ASEAN nations' economic integration at the aggregated and disaggregated levels. The aggregated analysis helps understand the impact of stringency measures at the economy level, and the disaggregated analysis involves the firm-level measures. Specifically, the study examines how the stringency measures affected these economies' macro indicators, including trade and tourism, in the first step. In the second step, the study identifies significant events through search procedure and statistical analysis and confirms these events' impact using *Event Study Methodology* (ESM) at the firms' levels. The analysis of these two dimensions may provide necessary policy support for experts. The study analyses ASEAN-6 countries: Thailand, Indonesia, Malaysia, Vietnam, Singapore, and the Philippines. As a comparative analysis, the study also includes South Korea, Japan, and China for some dimensions.

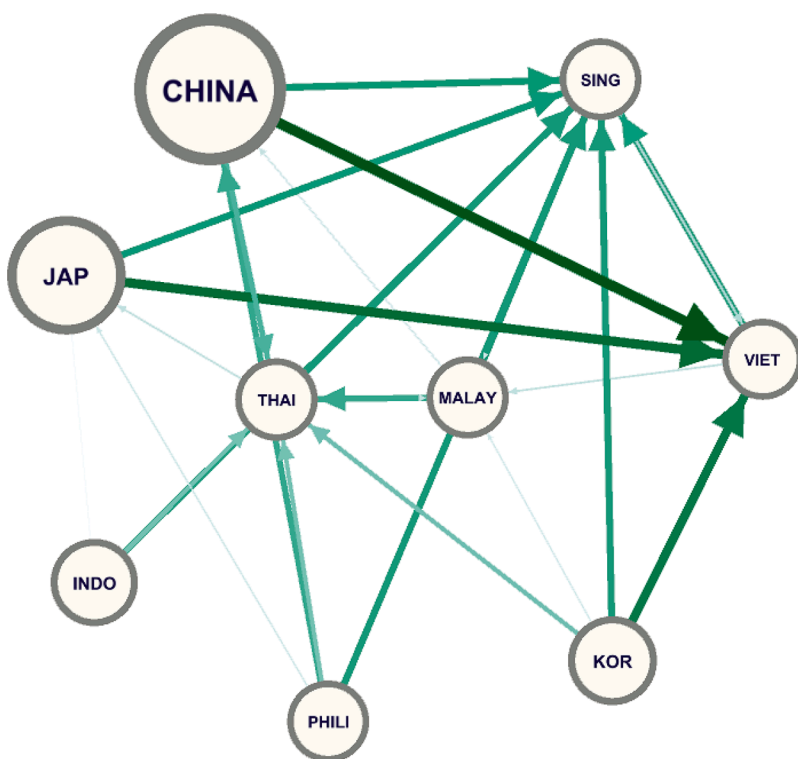
In this background, we outline the objectives of this study as follows: (1) To examine the spillover of stringency measures on major ASEAN nations' bilateral trade and tourism. (2) To develop the causal network between coronavirus outbreaks and the measures of economic integration. (3) To confirm whether the impact of coronavirus outbreak events is symmetric across firms. (4) To find whether firms' network based on their directional connectedness helps identify the significant lead and lagged sectors and firms. The firm-level analysis makes the study unique in the Southeast Asia context.

The rest of the paper is organised as follows. Section 2 reviews the existing and relevant studies and identifies the research questions. Section 3 discussed the data and empirical methodology. Section 4 discusses the empirical results, followed by section 5, which concludes the study.

## 2. Literature review

Many studies provide the macroeconomic analysis of the pandemic,

<sup>2</sup> Source: <https://www.csis.org/programs/southeast-asia-program/projects/past-projects/southeast-asia-covid-19-tracker> (accessed on June 15, 2022).



**Fig. 2.** Directional spillover (Stringency Index).

Note: The node shows the economy's size, which is the average of these countries' GDP in the last five years. The largest node shows the largest economy in the sample. The edge shows the strength of spillover. The color scheme is as follows: The cream color shows the nodes and the size of node decides the size of the economy. The dark green colour shows the network's strongest spillover effect (edge), and the light green shows the weakest relation. The degree of spillover effect goes down with the faded green color. The spillover effect is calculated using the Diebold and Yilmaz (2014) approach. Country abbreviations are INDO: Indonesia, THAI: Thailand, VIET: Vietnam, KOR: South Korea, PHILI: Philippines, MALAY: Malaysia, JAP: Japan, SING: Singapore.

and the firm level is missing. In the global context, Zhang et al. (2020) provide empirical evidence on the impact of a pandemic on ten major economies and confirm the significant impact. Akhtaruzzaman et al. (2020) study the risk spillover during the peak of the coronavirus outbreak between China and G7 and found evidence of financial contagion. At the sectoral level, Haroon and Rizvi (2020) analyse the sectoral indices of the US stock market with global benchmarks and suggest the significant volatility effect during the pandemic's peak. Goodell and Huynh (2020) analyse US lawmakers' trading behavior during the pandemic's peak using an event-study-specific methodology. They found that the trading was more inclined towards medical and pharmaceutical stocks. Ahmad et al. (2021) identify and find the significant effect of black swan events on Europe, the USA, and the UK sectors. They identified the bright sectors for investment during this period. Ahmad et al. (2021a), use the implied volatility indicators to showcase the connectedness using directional and frequency-based connectedness models. They find that the stock market's volatility has a stronger effect on the US sectoral returns than the crude oil volatility and gold.

At the firm level, too, we find some studies examining the cause and effect between pandemic and stock performance. Harjoto et al. (2020) showcase the heterogeneous effect of the pandemic stimulus on the firms and find that the large firms derived greater benefits than the smaller firms. Ahmad et al. (2021b) examine the firm-level dynamics of the US, UK, Japan, and Europe at the firm level. Using the event-study methodology and endogenous structural break on large and small firms during the first and second waves of the pandemic. They find the heterogeneous effect of pandemic events on the returns of these stocks and the idiosyncratic risk.

For ASEAN nations, Djalante et al. (2020) provide a summary of measures undertaken to contain the spread of coronavirus outbreaks in ASEAN. Using content analysis and news coverage analysis, they report the collective response of different measures from January to August 2020. Kimura et al. (2020) provide an early signal of the unfolding of the coronavirus pandemic impact on the southeast Asian nations. Bakar et al. (2021) developed a lockdown model using univariate time-series

models for January-August 2020. The ASEAN countries include Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Their model shows the rise in the number of cases during restriction periods. Chong, Li, and Yip (2021) examine the differential impact of coronavirus outbreaks on the ASEAN nations during the first two quarters of 2020. They suggest the worsening of economic indicators due to the pandemic. La and Miranti (2021) examine the coronavirus outbreak from financial markets' perspectives, using the data of stock markets to capture the policy response measures undertaken to contain the spread of the virus. They find evidence of herding behaviour in the stock markets. Taghizadeh-Hesary et al. (2022) examine the credit guarantee scheme implemented in ASEAN and cover the pandemic to revive small and medium enterprises. They suggest that a quicker recovery will require an enhanced credit guarantee scheme. Purnomo et al. (2022) examine the adaptive strategies of ASEAN nations. They rate Thailand as a country well prepared among the six ASEAN nations. Lean et al. (2022), in their book, highlight the pandemic's policy measures and socio-economic impact and suggest mitigation strategies. Katsumata (2022) highlights the equi-distant policy of the ASEAN during the pandemic and how it has received support from big powers. The favorable relationship with China has also paid the dividend. Enzmann and Moesli (2022) discuss the implications and challenges of the fourth industrial revolution that the region is staring at. The study suggests focusing on the quality of human capital and establishing strong regulatory institutions to support regulatory infrastructure changes. Morgan et al. (2022) provide household-level evidence on the impact of the pandemic on different household segments in ASEAN nations.

In light of the above studies and their contrasting findings, this study aims to answer the following research questions: First, how have the stringency measures impacted economic integration among ASEAN-6 nations? In other words, how far the measures undertaken to curb the spread of the virus have impacted trade integration and tourist flows? Second, what is the extent of spillovers of the Pandemic-related stringency measures? Third and last, is it possible to examine the coronavirus outbreak events across firms and sectors? In other words, from a regional integration perspective, is it possible to identify the firms which

are either badly impacted or benefited during the pandemic? To our knowledge, these questions are still unanswered in the context of ASEAN-6 nations. They may support the policy experts in formulating a recovery plan in the ASEAN group. This study is a maiden attempt.

### 3. Data and empirical framework

#### 3.1. Data

The study uses the Stringency Index (SI) data of ASEAN-6 and China, Japan, and South Korea for aggregate level analysis. The ASEAN-6 includes Indonesia, Malaysia, Singapore, Thailand, Philippines, and Vietnam. The SI index is developed to capture the stringency measures undertaken during the lockdown and social restrictions. Oxford University has developed the SI as COVID-19 Government Response Stringency Index (Stringency Index). Bilateral exports and bilateral arrivals of tourists are considered variables of economic integration. The study also includes China, Japan, and South Korea because these countries are strong regional partners in Southeast Asia. The study's sample period is May 02, 2019, to October 31, 2020. The study takes the stock market perspective and analyses the broad indices' stocks for firm-level analysis. To do this, we download the daily stock price data of the constituents of representative stock market indices. For firms' classification, the study has planned to use total assets as size and employees. All the sample data are retrieved from the Thomson DataStream. Lastly, the John Hopkins Coronavirus Resource Center will obtain the coronavirus cases and death data.<sup>3</sup>

Fig. 2 shows the network chart that exhibits the strength of the directional spillover effect. The points of attraction are Singapore and Vietnam. Singapore appears as a strongly connected country in ASEAN-6 as it receives the spillover from China, Japan, Thailand, South Korea, and the Philippines. Vietnam exhibits the strongest directional spillover effect of stringency measures coming from Japan, China, and South Korea. Thailand is another country that shows a high spillover effect with most countries, though the strength of spillover effect is weaker than in Vietnam. Overall, the network chart helps conclude that the stringency measures are taken to curb the coronavirus outbreak significantly impacted the economic integration of intra-ASEAN-6 nations and between ASEAN and non-member nations like China, Japan, and South Korea. The study also constructs the spillover network moving from stringency index to bilateral exports to disentangle the above findings, as trade relations are critical determinants of economic integration in Southeast Asia.

#### 3.2. Empirical framework

The empirical scheme is as follows. First, the strength of economic integration at the country level is analysed using the directional spillover method given by Diebold and Yilmaz (2014, hereafter DY2014). The main purpose is to find the dominance of one country over another on the directional spillover effect during the pandemic period represented by the Stringency Index. Second, to measure the extent of the economic implications of the pandemic on bilateral exports and tourist arrivals, the study constructs the causality networks from the estimates of Granger causality (Granger, 1969).

To measure the directional spillover effect, the variance decomposition-based method of DY2014. This method introduces the sample variables as a reduced-form model in the first step, followed by calculating forecast error variance decompositions. Suppose we have  $n$ -variate process  $y_t = (y_{t,1}, \dots, y_{t,n})$  be described by the structural VAR( $p$ ) at  $t = 1, \dots, T$  as:

$$\Phi(L)y_t = u_t \tag{1}$$

**Table 1**  
List of stock market indices.

Country	Stock market index	Number of firms
Thailand	Bangkok SET	614
Malaysia	FTSE Bursa Malaysia KLCI	30
Indonesia	Index Composite	708
Philippines	Philippines Stock Exchange I (Psei)	30
Singapore	Straits Times Index	30
Vietnam	Hochiminh Stock Exchange Vietnam Index	399

where  $\Phi(L) = \sum_{h=0}^H \Phi_h L^h$  is  $(n \times np)$  th order lag-polynomial and  $u_t$  is a residual term with white-noise property and has a non-diagonal covariance matrix  $\Sigma$ . The VAR process can be represented as the following moving average  $MA(\infty)$  representation if the roots of  $|\Phi(y)|$  lie outside the unit circle:  $y_t = \Psi(L)u_t$ , where,  $\Psi(L)$  is an  $(n \times n)$  infinite lag polynomial matrix of coefficients. In the DY method, the generalized forecast error variance decompositions are:

$$(\Theta_H)_{j,k} = \frac{\sigma_{kk}^{-1} \sum_{h=0}^H \left( (\Psi_h \Sigma)_{j,k} \right)^2}{\sum_{h=0}^H (\Psi_h \Sigma \Psi_h')_{j,j}}, \tag{2}$$

where  $\Psi_h$  is a coefficients matrix  $(n \times n)$  with lag  $h$  in parallel. The  $\sigma_{kk}$  is equal to sum of  $(k,k)$ . The input of the system variable  $k$ th to the forecast error variance of  $j$  element is denoted by  $(\Theta_H)_{j,k}$ . The variable shocks are non-orthogonalized. Hence, the total of each row of  $(\Theta_H)_{j,k}$  is usually  $\neq 1$ . So, by dividing the sum of rows, each element in the decomposition matrix can be normalized as follows:

$$(\tilde{\Theta}_H)_{j,k} = \frac{(\Theta_H)_{j,k}}{\sum_{k=1}^n (\Theta_H)_{j,k}}, \text{ with } \sum_{k=1}^n (\tilde{\Theta}_H)_{j,k} = 1 \text{ and } \sum_{i,k=1}^n (\tilde{\Theta}_H)_{i,k} = N \tag{3}$$

Then, as in the forecasts, the variances share is produced by other than errors forecast themselves, or, equally, as a percentage of the sum of the off-diagonal elements to the whole matrix sum:

$$C_H = \frac{\sum_{j \neq k} (\tilde{\Theta}_H)_{j,k}}{\sum (\tilde{\Theta}_H)_{j,k}} \times 100 = \left( 1 - \frac{Tr\{\tilde{\Theta}_H\}}{\sum (\tilde{\Theta}_H)_{j,k}} \right) \times 100 \tag{4}$$

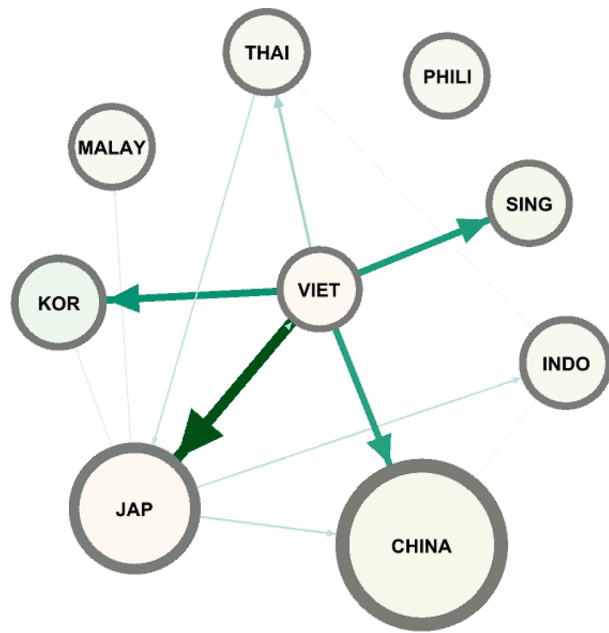
where the trace operator is denoted by  $Tr\{\cdot\}$ . The term  $C_H$  measures the total system connectedness. The study also estimates the directional spillovers received by  $j$  market from all other  $k$  markets and by  $k$  market from all other  $j$  markets. The net volatility spillovers differ between the directional spillovers received from and to the markets. The pairwise spillover results are used to construct the edge of the network.

Third, the study then analyses the impact of the coronavirus pandemic at the disaggregated level by analyzing the constituents of stock market indices mentioned in Table 1. To do this, the study adopts the two-step procedure. The first step involves identifying critical events related to the coronavirus outbreak using linear and non-linear structural break models, followed by the Event-Study Analysis (hereafter ESA) in the second step. A brief methodology is explained below. Under the linear structural break model, the study explores Bai and Perron (2003, hereafter BP). Although the model is linear, it used the general-to-specific estimation procedure. The main feature of this model is that it identifies the unknown structural break date based on  $supF_T(k, n)$  test, which tests the null hypothesis of no structural break ( $n = 0$ ) against the alternative of a structural break ( $n = k$ ). The null hypothesis remains the same for the double maximum and sequential test criteria, adding a methodological dimension to structural breaks.

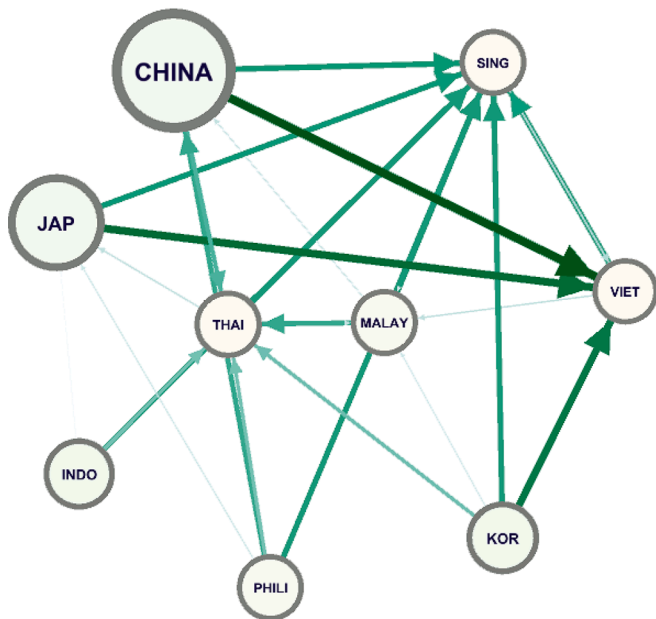
The study then explores the non-linear set-up of the Markov Switching (MS-DR (dynamic regression)) given by Doornik (2013). The study specifies the MS-DR model with switching intercept (means) and the variance:

<sup>3</sup> <https://github.com/CSSEGISandData/COVID-19>





Panel (a) Stringency to exports



Panel (b) Exports to Stringency

**Fig. 3.** The causal network between bidirectional exports and Stringency Index of ASEAN nations.

Note: The node shows the economy’s size, which is the average of these countries’ last five years’ GDP. The largest node shows the largest economy in the sample. The edge shows the magnitude of F-statistics (for the level of significance). The snow color shows the nodes and the size of node decides the size of the economy. The dark green colour shows the strongest spillover effect (edge) in the network, and the light green shows weakest relation. The degree of causal relationship goes down with the faded green colour. Country abbreviations are INDO: Indonesia, THAI: Thailand, VIET: Vietnam, KOR: South Korea, PHILI: Philippines, MALAY: Malaysia, JAP: Japan, SING: Singapore.

$$r_t = \alpha_i(S_t)r_{t-1} + \mu(S_t) + \varepsilon_t$$

$$\varepsilon_t \sim iid[0, \sigma^2(S_t)], S_t = 1, 2 \tag{5}$$

where the market return  $r_t$  is generated as an autoregression of order  $k$  with regime-switching in intercept (mean)  $\mu$  and variance ( $\sigma^2$ ).  $\alpha_i$  is the model parameter and  $\varepsilon_t$  is a residual term.  $S_t$  represents the regimes which take values 0 and 1, respectively, for regime 1 (bearish) and regime 2 (bullish). The study applies the structural break tests on the growth of total deaths due to coronavirus outbreaks and broad indices of sample countries. The appropriate sample is decided based on the availability of data. Finally, the study applies the Event Study Methodology (ESM) to investigate the event-specific impact on firms in consideration. Kim et al. (2020) also adopt the ESM procedure for their analysis. The study uses the ESM to measure the Abnormal Returns (AR) and Cumulative Abnormal Returns (CAR) to capture the firm-specific event-related effects. The market model is as follows:

$$ExR_{it} = \alpha_i + \beta(R_{mt} - R_{ft}) + \gamma CHINA_t + \delta JAPAN_t + \varepsilon_{it} \tag{6}$$

where  $ExR_{it}$  is the excess return of stock  $i$  at time  $t$ ,  $R_{mt}$  is market index return,  $R_{ft}$  is the risk-free return at time  $t$ ,  $CHINA_t$  and  $JAPAN_t$ , respectively the excess market returns of China and Japan at time  $t$ , and  $\varepsilon_{it}$  is the error term.  $\alpha, \beta, \gamma$ , and  $\delta$  are estimated parameters.

The study evaluates 175 trading days with a 30-trading day gap from the observation period.

Utilizing the estimated market model, AR and the CAR values are calculated:

$$AR_{it} = R_{it} - E(R_{it}) \tag{7}$$

$$CAR_i = \sum_{t=t_0}^{t_1} AR_{it} \tag{8}$$

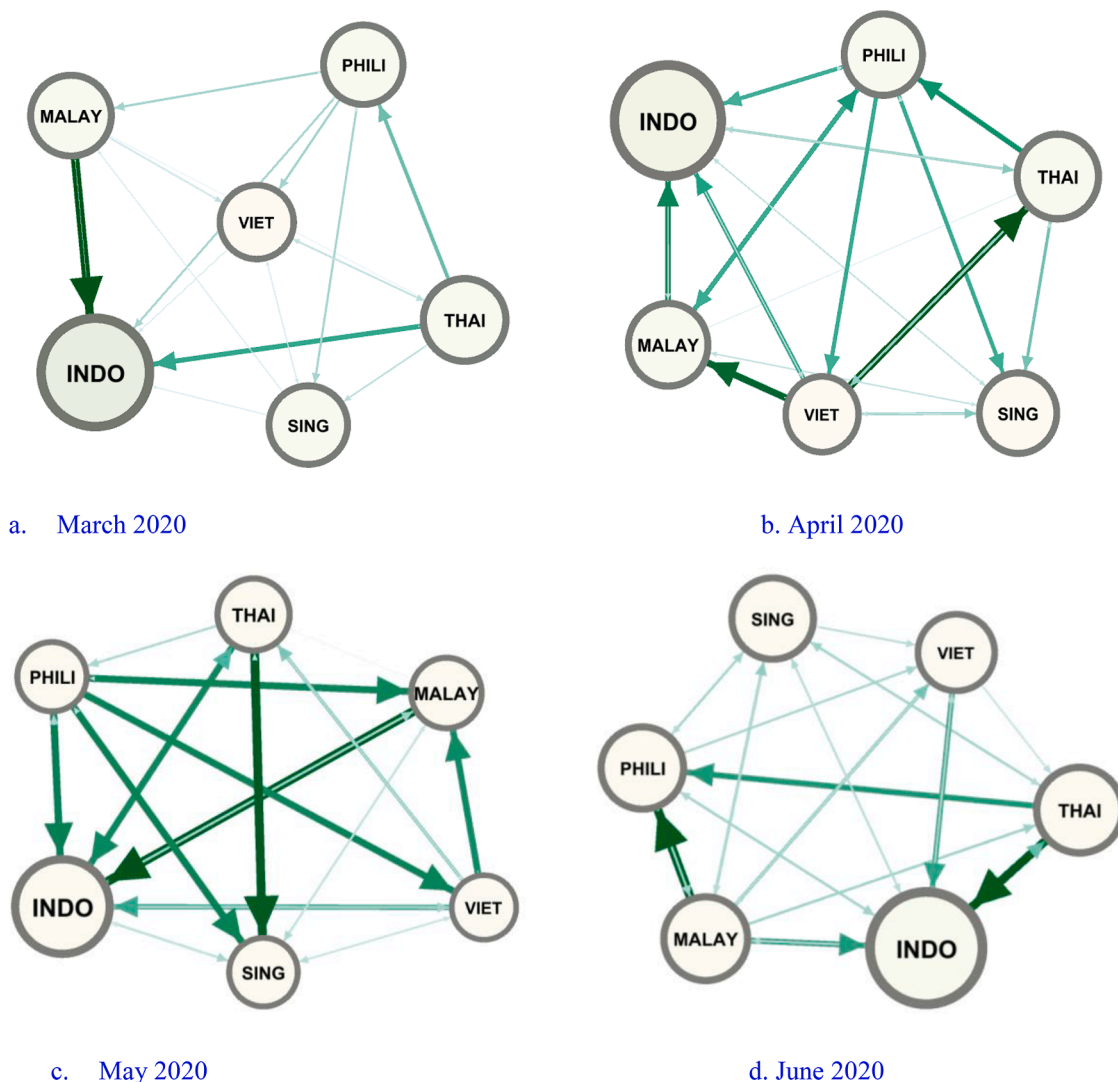
where  $R_{it}$  is the actual return of firm  $i$  at time  $t$ ,  $E(R_{it})$  is the estimated return using the computed market model. The  $CAR_i$  is then computed by taking the sum of the ARs over the chosen event window. To better isolate the event-specific abnormalities, short event windows of  $[-1, +1]$  are considered.

## 4. Results and discussion

### 4.1. Aggregate level analysis

The results are analyzed to explore the nature and direction of economic integration. The overall network is constructed using the sample data from March 20 to October 15, 2020. The study then considers bilateral exports as a proxy of economic integration and constructs the causal networks using the Granger causality test. From Fig.3, the stringency measures of Vietnam appear to exhibit strong causal dependence on Japan, China, and South Korea. This result suggests that the stringency measures taken by Vietnam impacted most of its trading partners. Vietnam and Japan enjoy strong trade ties, and during the pandemic, the trade between the two countries went up by 6.4%. The network chart also shows the effect of stringency measures on Japan’s bilateral exports to South Korea, Malaysia, Indonesia, and China.

Overall, the results suggest that the lockdowns, travel, and cross-border restrictions significantly impacted the bilateral exports of ASEAN-6 nations. The significant impact of China, Japan, and South Korea also validates these countries’ inclusion in the analysis. Further, the causal directions substantiate the policy dialogues between ASEAN and China, Japan, and South Korea. In April 2020, establishing the ‘COVID-19 ASEAN Response Fund’ and ‘Special ASEAN Summit on Coronavirus Disease 2019 (COVID-19)’ are key measures undertaken to strengthen the economic ties (Shimizu, 2021). The study also constructs the Granger-causality network moving bilateral exports to the stringency index. The bilateral exports appear to significantly impact the



**Fig. 4.** The periodic networks of bilateral exports among ASEAN-6 nations.

Note: The node shows the economy’s size, which is the average of these countries’ last five years’ GDP. The largest node shows the largest economy in the sample. The edge shows the magnitude of bilateral exports. The color scheme is as follows: The snow color shows the nodes and the size of node decides the size of the economy. The dark green colour shows the strongest spillover effect (edge) in the network, and the light green shows weakest relation. The degree of causal relationship goes down with the dark green to faded green. Country abbreviations are INDO: Indonesia, THAI: Thailand, VIET: Vietnam, PHILI: Philippines, MALAY: Malaysia, SING: Singapore.

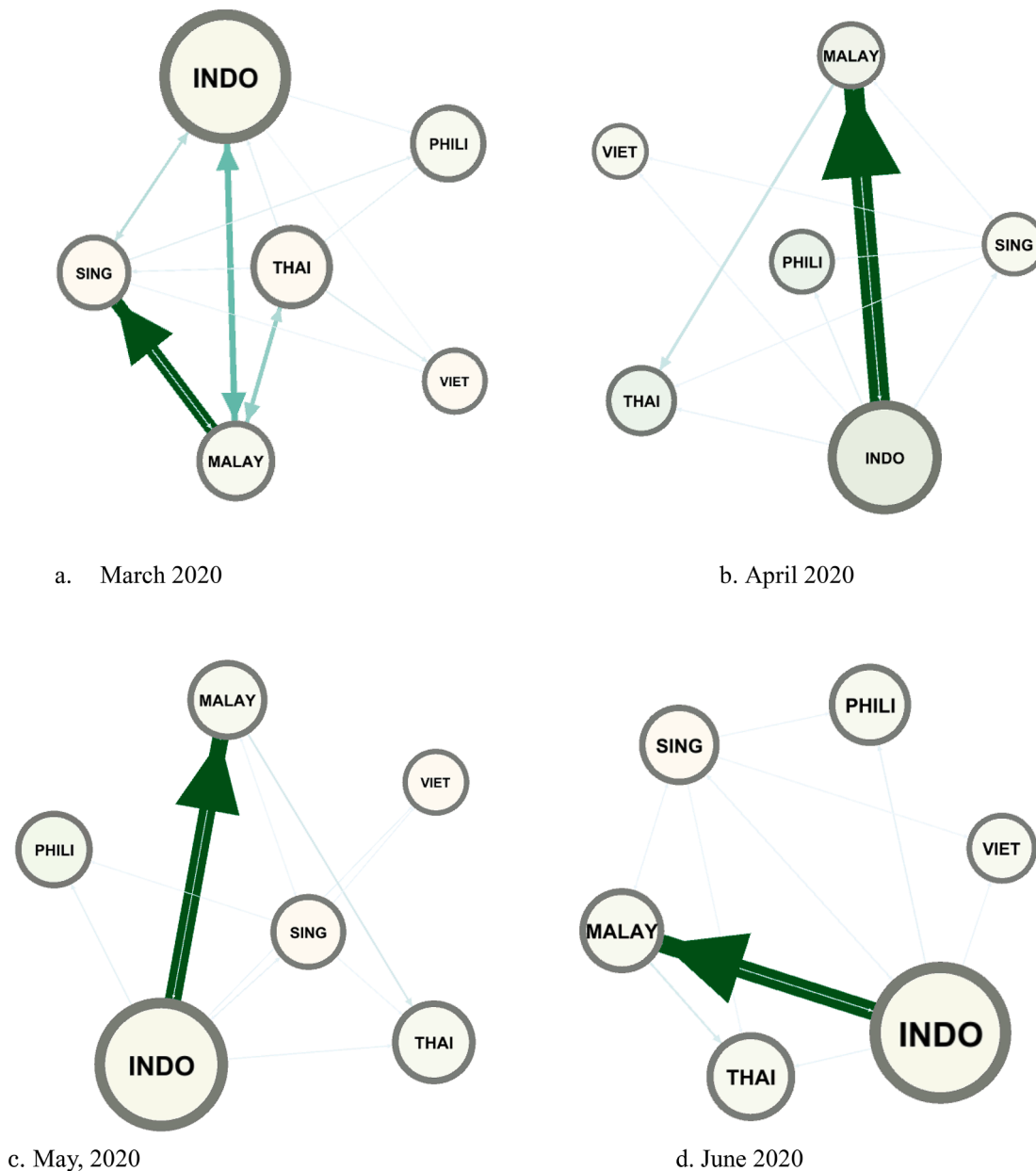
stringency measures undertaken by Thailand, Singapore, and the Philippines. The strong trade moving from Thailand to Singapore and the Philippines to Thailand signifies the critical role of trade and intra-ASEAN trade.

The study further analyses the above scenarios by introducing the bilateral exports and examining the intra-ASEAN-6 trade channels over four months from March-June 2020 (Fig. 4). The study constructs the export network using actual data on the bilateral exports extracted from Thomson DataStream. During March, there is a limited bilateral export between ASEAN-6 nations due to stringency measures such as lockdowns and travel restrictions. With the exceptions of Malaysia and Indonesia, the volume of bilateral exports is meager and negligible. From April onwards, export networks were visible, and they continued in May and June, though the trade networks of Singapore and Vietnam were not as appealing as other nations. In June, there was a significant decline in bilateral exports. The reason could be the rise in Coronavirus cases and sufficient exports of produced products during April and May. The resumption of full-fledged exports may take some time as the stringency measures have broken the production line and labor

availability.

Like the previous exercise, the study also analyses the state of bilateral tourists’ arrivals and constructs the networks for the four months: March, April, May, and June. According to ASEAN Policy Brief (April 2020), travel and tourism accounted for 12.6% of the ASEAN’s economy.<sup>4</sup> It is also observed that since March 2020, the bilateral tourist arrivals have been the lowest. Fig. 5 reveals that the tourist arrivals continued from Indonesia to Malaysia despite the pandemic restrictions. The network also shows that among the sample ASEAN-6 nations, Singapore, Thailand, the Philippines, and Vietnam seemed to have controlled the flow of tourists, which may have impacted these economies dearly. However, from the coronavirus outbreak perspective, these measures have helped these economies tame the infection rate. The strong connectedness indicates the substantial economic impact concerning domestic measures such as lockdowns and closing of borders,

<sup>4</sup> 1st ASEAN Policy Brief: Economic Impact of COVID-19 Outbreak on ASEAN, [https://asean.org/?static\\_post=asean-policy-brief-2](https://asean.org/?static_post=asean-policy-brief-2) (Accessed on February 15, 2021).



**Fig. 5.** The periodic networks of bilateral tourist arrivals among ASEAN-6.  
 Note: The node shows the economy’s size, which is the average of these countries’ last five years’ GDP. The largest node shows the largest economy in the sample. The edge shows the magnitude of bilateral tourists. The color scheme is as follows: The snow color shows the nodes and the size of node decides the size of the economy. The dark green colour shows the strongest spillover effect (edge) in the network, and the light green shows weakest relation. The degree of causal relationship goes down with the dark green to faded green. Country abbreviations are INDO: Indonesia, THAI: Thailand, VIET: Vietnam, PHILI: Philippines, MALAY: Malaysia, SING: Singapore.

flights, consignments, etc.

Overall, the bilateral exports and tourism arrivals analysis reveal the infection rate and the implementation of stringency measures in ASEAN-6 economies. From the analysis, Indonesia, Malaysia, and Singapore are the most vulnerable countries. Vietnam, Thailand, and to some extent, the Philippines fall into less infected countries. The most striking finding is tourists’ bilateral flow, signifying that the analysis has rightfully drawn the Southeast Asian region’s contours. These results are further substantiated by Chong et al. (2021) and Katsumata (2022). They also find Singapore, the Philippines, Indonesia, and Malaysia as the most pandemic-vulnerable countries during the first two quarters of 2020. However, on the effectiveness of pandemic measures, our study differs from Bakar et al. (2021), who concluded that the stringency measures were effectively implemented in Thailand, Singapore, and Malaysia.

#### 4.2. Disaggregate level analysis

The events identified by the linear and non-linear endogenous structural breaks are analysed in this subsection. The Bai-Perron (2003) structural break test identifies major events reported in Table 2. The results indicate that the pandemic had major impacts in March and April 2020. This result is further confirmed by the plots of smoothed probabilities of major stock markets against the growth in deaths and cases related to Coronavirus. Fig. 6 shows the plot of MSM. The stock markets also witnessed a bearish regime due to the reports of the highest deaths and cases during March and April. The related events are listed in Table 2.

After analysing the country-specific parameters for better growth and development, the study performs a micro-analysis and confirms

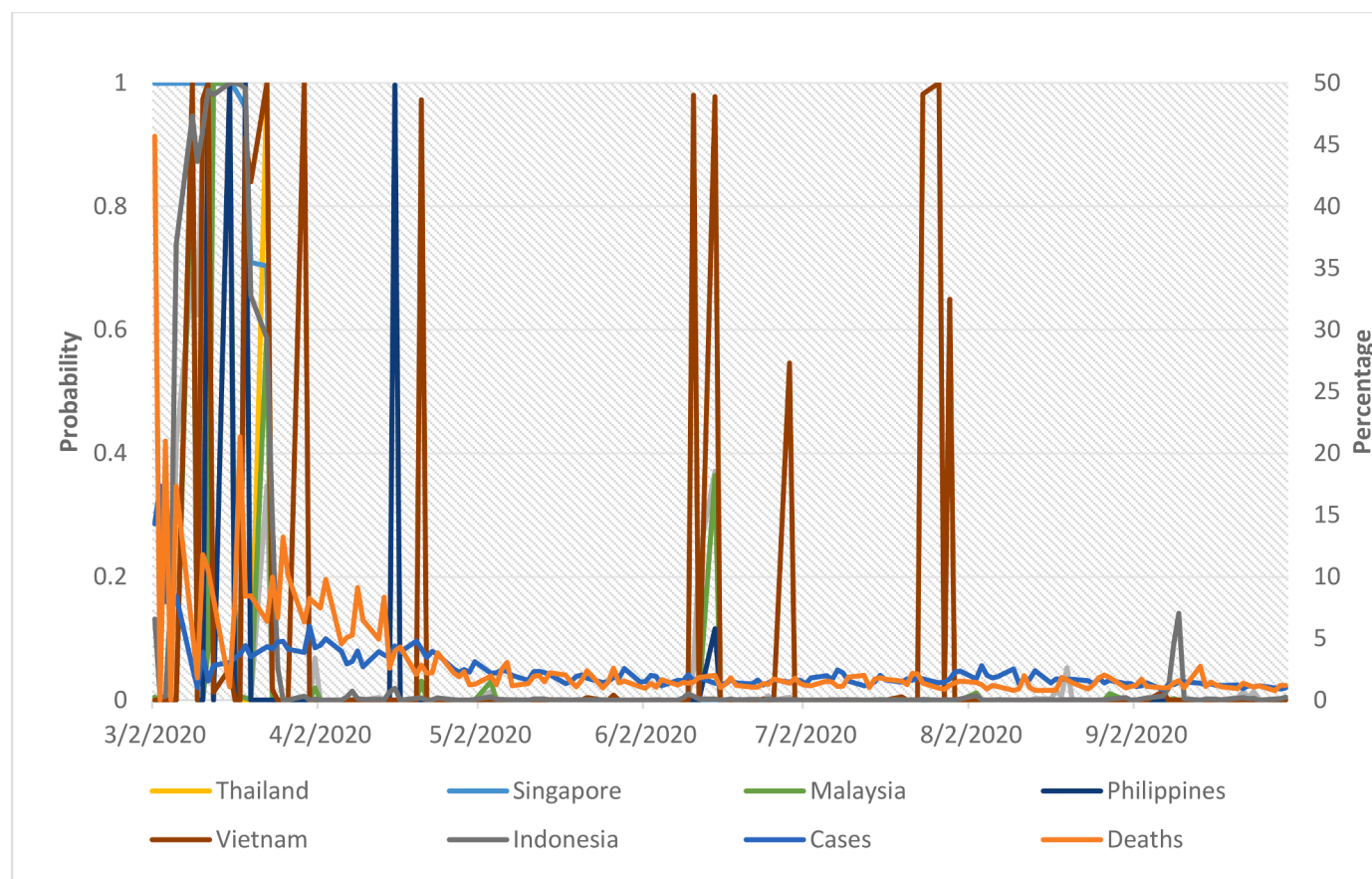


Fig. 6. The performance of ASEAN stock markets during the Pandemic.

Note: The primary axis shows the Smoothed Probabilities of stock markets being in a bearish regime, and the secondary axis shows the percentage growth of the total number of Coronavirus cases and deaths in ASEAN nations.

whether the pandemic's impact has been symmetric across firms. For each event date, the Abnormal Returns (ARs) and Cumulative Abnormal Returns (CARs) are calculated using Eqs. (7) and (8). We adopt the parametric approach of the Event Study Analysis. As Eq. (7) mentions, the negative AR values imply the excess of returns over an expected return and negative abnormal returns. The negative (positive) value implies underreaction (overreaction) of stocks to a particular event. In other words, the negative (positive) values suggest adverse (favorable) effects of events.

The significance of each event date is decided based on the magnitude of t-statistics. AR and CAR values are sorted based on their magnitudes to infer the significance of event dates. Table 3 shows the ARs and CARs values based on size. The firms are sorted based on their size using five years of market capitalization. Panels (A-F) show the rankings of ASEAN-6 countries. To conserve the space, the results of [+1, -1] days are only reported. We also calculate the AR and CAR values for other windows, including [+2, -2] and [+3, -3]. However, we do not observe major differences in results. However, the results are available upon request. The CAR values are significant for all the firms, suggesting the considerable impact of the coronavirus outbreak. More precisely, for large firms, the CAR values of most firms are negative and statistically significant, indicating an adverse effect on these firms.

Similarly, for small firms, CAR values are negative and statistically significant for most firms, providing an impression that the unprecedented shock of the coronavirus outbreak impacted these firms. However, in the case of small firms, the Philippines and Malaysia exhibit a greater sensitivity to pandemic shock than the rest of the countries. The possible explanation could be the lower number of firms listed on the stock exchange. However, a comparative analysis reveals that the

sectors which became more sensitive to the coronavirus outbreak are personal goods, banks, industrial metal and mining, industrial transportation, general industries, and others. Most of the sectors appear to be sensitive to country-specific events. This result is supported by the Narjoko (2020), who suggests that the pandemic significantly impacts sectors that are part of global value chains. As ASEAN economies are also major raw material exporting countries, the pandemic has caused damage to the mining and industrial metal sectors. Singapore has a large population of foreign workers, and stringency measures further impacted the progress of real estate and infrastructure, negatively impacting industrial transportation and general industries (Chong et al., 2021).

To summarize, it is apparent that the pandemic has impacted both large and small firms; hence, these countries may have to chalk out a special package to revive these firms. Special attention may be given to firms in Indonesia, Vietnam, and Thailand. Singapore, Malaysia, and the Philippines should focus more on large firms than small ones. Small firms' findings suggest the coronavirus pandemic's significant impact on small and medium enterprises. In this regard, the study of Taghizadeh-Hesary et al. (2022) seem relevant as it highlights the adverse impact of the coronavirus pandemic on small and medium-sized firms and how credit guarantee schemes may help these firms to recover.

The study now analyses the firms based on the number of employees, keeping in mind their employment capabilities. The main purpose is to provide a comparative overview of the employment loss of the firms. It is expected that the results from the previous analysis may be different in this case as the ranking of small firms may also vary. A cautious effort has been made to minimise the overlap of a few firms, but the calculations reflect the coronavirus impact. Table (4, Panels A-F) shows the top



**Table 2**  
List of events identified using multiple structural breaks models.

Even Date	Events	Source
<b>March 18</b>	The announcement of nationwide lockdown in Malaysia. Good and services between Malaysia and Singapore were affected. Travel bans by the European Union. Malaysia introduces movement control to contain the virus spread	Straitstimes and South China Morning Post and CSIS
<b>March 27</b>	Postponement of Summer Olympics in Tokyo to 2021. The US announced a mega stimulus package. Restrictions on public gatherings in Hong Kong. Japan gave a one-year grace period.	Straitstimes and CSIS
<b>April 3</b>	Announcement of 'circuit breaker' by Singaporean authority. Cases crossed one million.	Straitstimes and CSIS
<b>April 14</b>	The case of S11 dormitory and PPT Lodge 1A in Singapore. Global economy slides towards recession. IMF predicted the growth of the global economy by 3%. Philippines approved USD 1 billion wage subsidy package.	Straitstimes and CSIS
<b>April 30</b>	Changi Airport Terminal 2 suspended the flight operations. Airline services resumed in the US and other countries. Vietnam began exporting domestically produced kits and medical equipment.	Straitstimes and CSIS
<b>May 27</b>	Singapore announced a \$33 Billion Fortitude budget. COVID-19 related deaths crossed 100,000 people. Singapore took measures to phase-out lockdown. Indonesia deployed the army and police personnel to implement the Pandemic-related protocols.	Straitstimes and CSIS
<b>August 26</b>	Singapore and Indonesia initiated to talk to open the travel corridor. Malaysia reverses the travel entry ban to ex-pats.	Straitstimes and CSIS
<b>September 10</b>	Singapore implemented a 'multi-layered strategy' to detect new cases of Coronavirus. ASEAN-US foreign ministers meeting that focussed on the health and human development. Vietnam announced revised quarantine rules for foreign travelers. Philippines announced USD 3.4 billion pandemic relief package. Rating agencies predicted an economic contraction of 8% for the Philippines. Enforcement of pandemic-related protocols in Indonesia, armies, and national police was deployed.	Straitstimes and CSIS

CSIS: Center for Strategic and International Studies.

10 large and small firms based on employees. Firms in Malaysia (large and small) seem to have a more substantial impact on the pandemic than the rest of the firms, suggesting that the government's stimulus plan should include both types of firms. However, for Malaysia, the impact seems more visible in the small firms as AR and CAR values are more negative than in the large firms. Therefore, policy experts must be cautious about rescue measures and provide extra incentives to small firms.

In the case of Vietnam, the large firms are more vulnerable to the Coronavirus pandemic effect than the small firms though the AR and CAR values are not uniformly significant. In Singapore, large firms are more impacted by pandemics than small firms. Overall, a comparative analysis of both sizes (market capitalization and the number of employees) reveals a differential impact of the coronavirus pandemic across firms. The effect is more severe, and uniforms for both large and small firms are on their size. The ranking based on the number of employees does not wilfully substantiate the findings based on size.

The application of endogenous structural break models methodologically seems appropriate as it captures the major developments during the coronavirus outbreak. Further, the event study analysis at the firm level captures the major developments in 2020. The analysis shows the validity of these models for such an events-centric study. In the literature, similar schemes are also implemented by He et al. (2020), Alam et al. (2020), Sayed and Eledum (2021), Ahmad et al. (2021), and Ahmad et al. (2021b). These authors suggest the appropriateness of event study analysis of coronavirus data and stock market performance.

#### 4.3. Comparative analysis of ASEAN-6 and China, Japan, and South Korea

As mentioned above, China, Japan, and South Korea are critical regional partners for ASEAN-6 nations. The ASEAN+3 meetings during April 2020 signify economic cooperation and regional harmony. As a comparative, we also conduct an ASEAN+3 analysis. We consider China, Japan, South Korea, and ASEAN-6 nations. The main motivation to include these countries is that these nations play a crucial role in economic integration and are among the major trade and tourism partners. To keep this in mind, a periodic network graph for March, April, May, and June is developed for bilateral exports and tourist arrivals. Fig. 7 shows the bilateral export networks of ASEAN-6 and China, Japan, and South Korea. During March, the export network from Malaysia to Indonesia was active compared to other nations. Vietnam also shows export dependence on China. Thailand shows export dependence on the Philippines and Indonesia. Overall, during March, the network plot reveals the sub-optimal level of export connectedness. China's export networks, Japan and South Korea do not reflect the strong inflow and outflow of trade goods. However, in April, the trade networks are revived as more networks are strongly visible. Vietnam is strongly connected to Thailand and Malaysia, followed by the Philippines to Vietnam and Indonesia. The trade network between ASEAN-6 and three nations (China, Japan, and South Korea) seemed weaker than the intra-ASEAN-6 trade. In May, the economic revival continued, and it was observed that the bilateral exports between ASEAN-6 and three nations strengthened during this period. The most robust connections were from Thailand to Singapore and Malaysia to Indonesia. The revival of trade networks could be because of the imports and exports of medical equipment and food items. The trade networks seemed to have stabilized in June as intra-ASEAN-6 trade is more visible than among the three nations.

However, the coronavirus pandemic's impact has impacted the bilateral exports between ASEAN-6 and China, Japan, and South Korea, which became visible in March 2020. April onwards, the trade networks started reviving with the economy's opening and excess export and import of medical supplies and equipment. Overall, it is observed that during the pandemic, the intra-ASEAN trade remained a backbone.

As aforementioned, the tourism sector is the backbone of some of the ASEAN-6 economies. The study constructs the networks of ASEAN-6 and China, Japan, and South Korea's bilateral tourist arrivals (see Fig. 8). In March 2020, intra-ASEAN-6 nations had the inflow and outflow of tourists but not from China, Japan, and Singapore. Malaysia and Singapore and Malaysia and Indonesia had the tourist inflow. However, in the rest of the months (April, May, and June), the inflow is seen from Indonesia to Malaysia and nowhere else. The actual data also reveals that the tourist arrivals in some months have been zero for some countries.

Overall, it is apparent from the above analysis that even after incorporating China, Japan, and South Korea, the trade networks and tourism sector outlook do not change, signifying the critical role of stringency measures and coronavirus outbreaks. The Coronavirus pandemic has wholly stopped the economically prosperous and thriving region of ASEAN. The analysis also shows the impact of the pandemic on economic integration. These findings align with the action plan of the ASEAN+3 meeting held on April 14, 2020, to mitigate the pandemic

Table 3

Top 10 large and small companies based on their size.

Panel A: Indonesia			
Sectors	Firms (Large)	AR	CAR
Banks	Bank Rakyat Indonesia	0	0.002
Fixed Line Telecommunications	Telekomunikasi Indonesia (Persero)	-0.009	-0.007
Personal Goods	Unilever Indonesia	-0.046	-0.091
Chemicals	Chandra Asri Petroch.	0.027	-0.124
Pharmaceuticals and Biotechnology	Kalbe Farma	0.091	0.172
General Retailers	ACE Hardware Indonesia	-0.007	-0.121
Mining	Adaro Energy TBK	-0.013	-0.035
Banks	Bank Danamon Indonesia	-0.038	-0.079
Banks	Bank Mayapada Intsl.	0.021	0.118
Banks	Bank Mega	0.031	-0.055
Banks	Bank Negara Indonesia	-0.026	-0.008
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Real Estate Investment and Services	Bekasi Asri Pemula	0.022	0.099
Industrial Metals and Mining	Jakarta Kyoel Steel Works	0.002	0.008
Financial Services (Sector)	Nusantara Inti Corpora	-0.007	0.096
Industrial Transportation	Armada Berjaya Trans	-0.048	-0.17
Mining	Perdana Karya Pekasa	-0.012	-0.063
Software and Computer Services	Tanah Laut	0.024	0.131
Travel and Leisure	Hotel Fitra International PT	-0.04	-0.084
Construction and Materials	Darmi Bersaudara	0.033	0.268
-	Wahana Pronatural	0.019	0.067
Industrial Transportation	Eka Sari Lorena	0.114	0.12
<b>Panel B: Malaysia</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
Health Care Equipment and Services	Top Glove Corporation	-0.01	0.01
Health Care Equipment and Services	Hartalega Holdings	0.01	0.078
Oil Equipment and Services	Dialog Group	0.036	0.07
Industrial Metals and Mining	Press Metal Aluminium Holdings	-0.109	-0.151
Real Estate Investment Trusts	KLCC Property Holdings Stapled Units	0.006	-0.001
Banks	Hong Leong Financial Group	0.039	-0.037
Fixed Line Telecommunications	Telekom Malaysia	0.035	0.044
Banks	RHB Bank Berhad	-0.019	-0.082
General Industrials	Hap Seng Consolidated	-0.019	0.001
Property and Diversified Group	PPB Group	0.005	0.026
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Banks	Malayan Banking	-0.008	-0.014
Banks	Public Bank	-0.05	-0.077
Electricity	Tenaga Nasional	0.035	0.073
Chemicals	Petronas Chemicals Group	0.025	0.007
Health Care Equipment and Services	IHH Healthcare	0.043	0.094
Banks	CIMB Group Holdings	-0.029	-0.096
Fixed Line Telecommunications	Maxis	0.027	-0.051
Fixed Line Telecommunications	Axiata Group	-0.027	-0.064
Industrial Engineering	Sime Darby	-0.005	0.068
Gas, Water and Multiutilities	Petronas Gas	0.023	0.066
<b>Panel C: Philippines</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
General Retailers	SM Investments	-0.019	-0.062
Real Estate Investment and Services	SM Prime Holdings	-0.064	-0.014
Real Estate Investment and Services	Ayala Land Inc.	-0.009	-0.015
Banks	BDO Unibank	-0.097	-0.035
Real Estate Investment and Services	Ayala Corporation	0.044	0.003
General Industrials	JG Summit Holdings Inc.	0	-0.022
Banks	Bank of the Philippine Islands	0.088	0.064
Electricity	Manila Electric Company	0.045	-0.004
Food Producers	Universal Robina Corporation	0.036	-0.033
General Industrials	Aboitiz Equity Ventures	0.084	0.168
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Electricity	First Gen	0.018	-0.015
Travel and Leisure	Bloomberry Resorts Corp	0.069	0.219
Food and Drug Retailers	Puregold Price Club	0.139	0.122
General Retailers	Robinsons Retail Holdings, Inc	0.049	0.133
Real Estate Investment and Services	Robinsons Land Corporation (RLC)	0.067	0.133
Beverages	Emperador	0.167	0.117
Banks	Security Bank Corporation	0.002	-0.093
General Industrials	Alliance Global Group, Inc	0.041	0.011
Real Estate Investment and Services	Megaworld Corporation	0.039	0.136
Banks	LT Group, Inc	0.066	0.105
<b>Panel D: Singapore</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
Beverages	Thai Beverage	0.015	-0.138
General Industrials	Jardine Strategic	-0.028	-0.186
General Industrials	Jardine Matheson Hdg.	0.002	0.046

(continued on next page)

Table 3 (continued)

Panel A: Indonesia			
Sectors	Firms (Large)	AR	CAR
Real Estate Investment and Services	Hongkong Land HLDGS	-0.016	<b>0.034</b>
Food and Drug Retailers	Dairy Farm International	<b>0.035</b>	<b>0.064</b>
Fixed Line Telecommunications	Singapore Telecom	0.013	0.001
Banks	DBS Group Holdings	<b>-0.016</b>	<b>0.027</b>
Banks	Oversea-Chinese Bkg.	0	<b>0.004</b>
Banks	United Overseas Bank	0.005	<b>0.037</b>
Industrial Transportation	Yangzijiang Shipbuilding Group	-0.016	<b>0.139</b>
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Real Estate Investment Trusts	Mapletree Industrial Trust	-0.01	<b>-0.162</b>
Real Estate Investment and Services	Mapletree Logistics Trust	<b>0.037</b>	<b>-0.117</b>
Technology Services	Venture Corporation Limited	<b>-0.03</b>	<b>0.056</b>
Real Estate Investment Trusts	Mapletree Com	<b>0.048</b>	<b>-0.024</b>
Gas, Water and Multiutilities	Sembcorp Industries	-0.019	<b>0.121</b>
Aviation	SATS LTD	0.012	<b>-0.084</b>
Travel and Leisure	ComfortDelGro Corporation	<b>0.022</b>	<b>-0.017</b>
Real Estate Investment and Services	UOL Group Limited	-0.017	<b>0.057</b>
Real Estate Investment Trusts	CapitaLand Commercial Trust	<b>0.031</b>	<b>-0.048</b>
Real Estate Investment Trusts	Ascendas	<b>0.036</b>	<b>-0.052</b>
<b>Panel E: Vietnam</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	
Food Producers	Vietnam Dairy Products	-0.012	
Gas, Water and Multiutilities	Petrovietnam Gas	<b>-0.032</b>	
Real Estate Investment and Services	Vinhomes	-0.011	
Beverages	Saigon Beer Beverage	<b>-0.041</b>	
General Retailers	Vincom Retail	-0.003	
Travel and Leisure	Vietjet Aviation	-0.005	
Food Producers	Masan Group	0	
General Industrials	HOA Phat Group	<b>0.024</b>	
Travel and Leisure	Vietnam Airlines	<b>-0.024</b>	
Real Estate Investment and Services	NO VA Land Investment Group	-0.014	
<b>Sectors (small)</b>	<b>Firms (Small)</b>	<b>AR</b>	
Support Services	Petrolimex International Trading	0.021	
Construction and Materials	HUD3 Investment & Const.	0	
Real Estate Investment and Services	COTEC Inv.& LD.-HSE.DEV.	0.061	
Real Estate Investment and Services	HUD1 Inv.& Construction	0.003	
General Retailers	Thai Duong Petrol	<b>0.058</b>	
Construction and Materials	Petroleum Pipe & TNK. Con.	-0.018	
Industrial Engineering	COMA 18	<b>0.068</b>	
Financial Services (Sector)	Anphat Securities	-0.013	
Mining	Laocai Mineral	0	
Real Estate Investment and Services	Ninh Van Bay Real Estate	<b>-0.082</b>	
<b>Panel F: Thailand</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
Oil and Gas Producers	PPT	0.007	<b>-0.024</b>
Industrial Transportation	Airports of Thailand	<b>-0.023</b>	<b>-0.062</b>
Food and Drug Retailers	CP All PCL	-0.007	-0.005
Construction and Materials	SIAM Cement Public	-0.004	<b>0.034</b>
Fixed Line Telecom.	Advanced Info. Service	<b>0.031</b>	<b>0.1</b>
Banks	SIAM Commercial Bank	<b>-0.024</b>	-0.007
Banks	Kasikornbank	0	-0.009
Oil and Gas Producers	PTT Exploration & Production	<b>-0.03</b>	<b>-0.065</b>
Health Care Eq. and Ser.	Bangkok Dusit Medical Services	<b>0.035</b>	<b>0.008</b>
Banks	Bangkok Bank Limited	0.012	<b>-0.066</b>
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Household Goods	Fancy Wood Industries	<b>0.122</b>	<b>0.168</b>
-	CPL Group PCL	<b>0.127</b>	<b>0.255</b>
General Retailers	Copperwired PCL	-0.019	-0.015
Construction and Materials	Capital Engineering	<b>-0.094</b>	0.009
-	CPT Drives and Power	-0.006	<b>0.019</b>
-	Bangkok Commercial Property	<b>-0.018</b>	0.003
Industrial Engineering	Alla PCL	0.007	<b>-0.033</b>
Food Producers	Chumporn Palm Oil Industries	0.021	<b>0.127</b>
Industrial Metal and Min.	ASIA Metal	0.001	<b>0.029</b>
Industrial Metal and Min.	Bangsaphan Barmill	0.013	<b>0.089</b>

Notes: March 18 is the date of sorting the AR and CAR values. ASEAN-6 to sort the firms based on their size (average of last five years market capitalization). Values in bold exhibit statistically significant values at 5% level of significance and better.

Table 4

Top 10 large and small companies based on the employees.

Panel A: Indonesia			
Sectors	Firms (Large)	AR	CAR
Automobiles and Parts	Astra International	0.013	0.023
Food Producers	Indofood Sukses Makmur	0.02	0
Banks	Bank Rakyat Indonesia	0	0.002
Food and Drug Retailers	Sumber Alfaria Trijaya	0.016	0.074
Banks	Bank Mandiri	-0.031	-0.032
Food Producers	Astra Agro Lestari	-0.055	-0.141
Tobacco	Gudang Garam	0.014	0.041
Food Producers	Indofood CBP Sukses Mkm.	-0.024	-0.061
-	United Tractors	0.027	0.01
Banks	Bank Danamon Indonesia	-0.038	-0.079
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Industrial Transportation	Buana Lintas Lautan	0.009	0.018
Gas, Water and Multiutilities	Rukun Raharja	-0.035	-0.091
Real Estate Investment and Services	Ristia Bintang Mahko.	0.016	0.05
Real Estate Investment and Services	Pollux Properti	0.059	0.052
Nonlife Insurance	Asuransi Kresna Mitra	0.012	-0.042
Real Estate Investment and Services	Bekasi Fajar Indl.Est	0.004	0.027
Personal Goods	Roda Vivatex	0.04	0.19
-	Waskita Beton Precast	-0.03	-0.04
Fixed Line Telecommunications	PT Bali Towerindo Sentra	0.123	0.144
Industrial Transportation	Transcoal Pacific	0.068	0.139
<b>Panel A: Malaysia</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
Gas, Water and Multiutilities	Petronas Dagangan	0.063	0.119
Fixed Line Telecommunications	Digitale Com	0.039	0.083
Gas, Water and Multiutilities	Petronas Gas	0.0226	0.066
Oil Equipment and Services	Dialog Group	0.036	0.07
Fixed Line Telecommunications	Maxis	0.027	-0.051
General Industrials	Hap Seng Consolidated	-0.019	0.001
Property and Diversified Group	PPB Group	0.0045	0.026
Chemicals	Petronas Chemicals Group	0.025	0.007
Food Producers	Nestle (Malaysia)	0.025	0.051
Industrial Metals and Mining	Press Metal Aluminium Holdings	-0.109	-0.151
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Food Producers	Sime Darby Plantation	-0.003	0.068
Industrial Engineering	Sime Darby	-0.005	0.068
Travel and Leisure	Genting	-0.022	-0.138
Banks	Malayan Banking	-0.008	-0.014
Banks	CIMB Group Holdings	-0.029	-0.096
Electricity	Tenaga Nasional	0.035	0.073
Health Care Equipment and Services	IHH Healthcare	0.043	0.094
Fixed Line Telecommunications	Telekom Malaysia	0.0348	0.044
Travel and Leisure	Genting Malaysia	0.0276	-0.044
Banks	Public Bank	-0.05	-0.077
<b>Panel B: Philippines</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
General Retailers	SM Investments	-0.019	-0.062
General Industrials	Alliance Global Group, Inc	0.041	0.012
Banks	BDO Unibank	-0.097	-0.035
General Industrials	San Miguel Corporation	0.037	0.043
General Industrials	JG Summit Holdings, Inc	0	-0.022
Real Estate Investment and Services	GT Capital Holdings Inc.	-0.003	-0.116
Fixed Line Telecommunications	PLDT, Inc.	0.023	0.079
Banks	Bank of the Philippine Islands	0.088	0.064
Real Estate Investment and Services	Ayala Land, Inc	0.044	-0.015
Travel and Leisure	Jollibee	0.066	0.033
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
General Industrials	DMCI Holdings, Inc.	0.016	0.042
Gas, Water and Multiutilities	Metro Pacific Invest. Corporation.	-0.021	-0.039
General Industrials	Aboitiz Equity Ventures	0.084	0.168
Real Estate Investment and Services	Ayala Land, Inc.	-0.009	-0.015
Real Estate Investment and Services	Megaworld Corporation	0.039	0.136
Electricity	First gen	0.018	-0.015
Beverages	Emperador	0.167	0.117
Real Estate Investment and Services	Robinsons Land Corporation	0.067	0.09
Electricity	Aboitiz Power Corporation	-0.12	-0.115
Banks	Security Bank Corporation	0.002	-0.093
<b>Panel C: Singapore</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
Real Estate Investment Trusts	CapitaLand Commercial Trust	0.031	-0.048
Real Estate Investment and Services	Mapletree Logistics Trust	0.037	-0.117
Real Estate Investment and Services	City Developments Limited	-0.003	-0.074
Real Estate Investment Trusts	CapitaLand Malls	0.04	-0.073

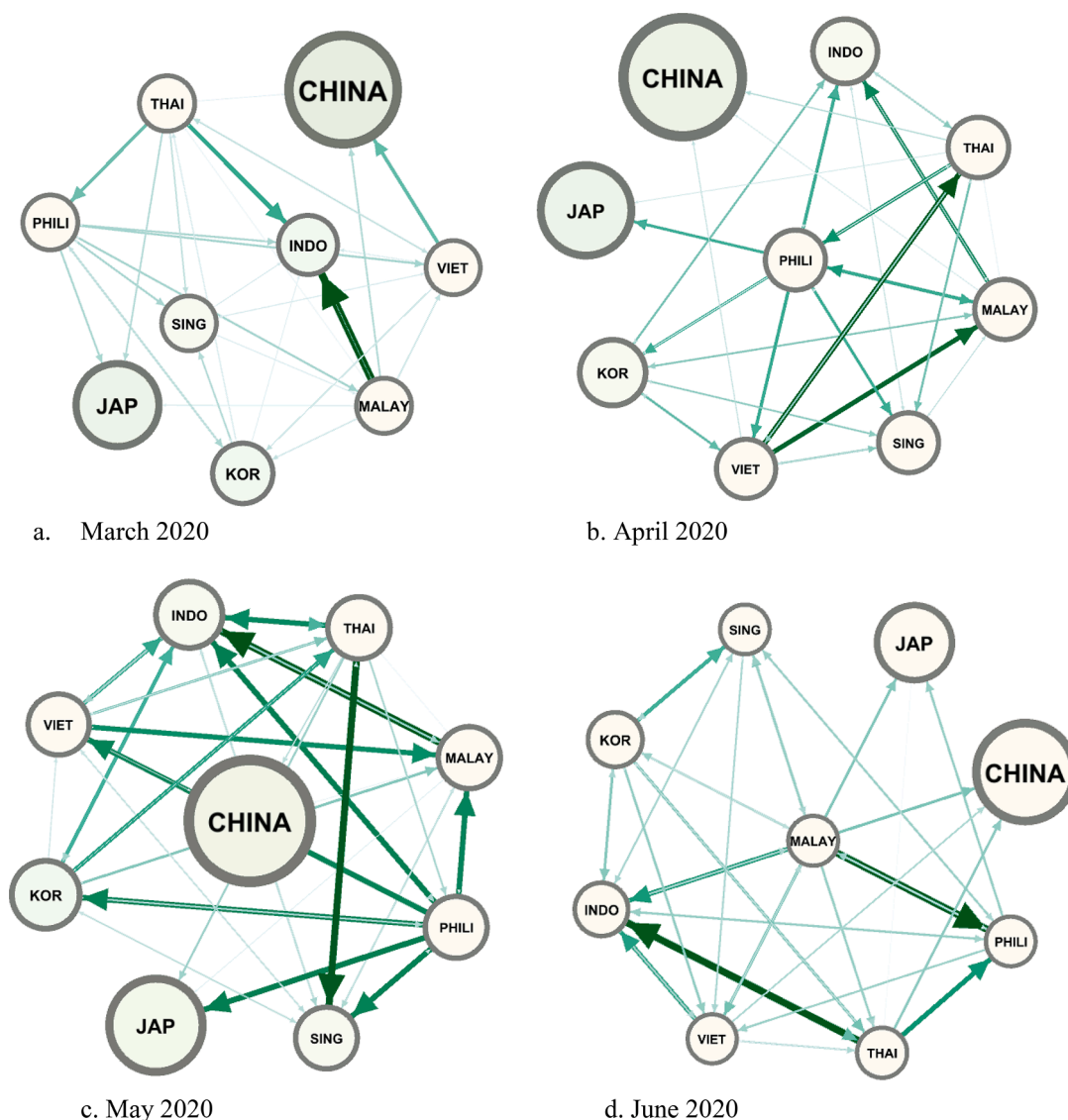
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Table 4 (continued)

Panel A: Indonesia			
Sectors	Firms (Large)	AR	CAR
Financial Services (Sector)	Singapore Exchange Limited	-0.004	<b>0.055</b>
Real Estate Investment and Services	Hongkong Land HLDGS	-0.016	<b>0.034</b>
Real Estate Investment and Services	UOL Group Limited	-0.017	<b>0.057</b>
Real Estate Investment and Services	CapitaLand Commercial Trust	-0.006	<b>-0.054</b>
Gas, Water and Multiutilities	Sembcorp Industries	-0.019	<b>0.121</b>
Travel and Leisure	Genting Singapore PLC	<b>0.059</b>	<b>-0.173</b>
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
General Industrials	Jardine Matheson Hdg.	0.002	<b>0.046</b>
Automobiles and Parts	Jardine Cycle & Carriage Ltd.	0.013	<b>-0.139</b>
Food and Drug Retailers	Dairy Farm International	<b>0.035</b>	<b>0.064</b>
Food Processing	Wilmar International Limited	-0.002	0
Banks	Oversea-Chinese Banking Corp.	0	<b>0.004</b>
Banks	United Overseas Bank	0.005	<b>0.037</b>
Travel and Leisure	Singapore Airlines	<b>-0.078</b>	<b>-0.049</b>
Fixed Line Telecommunications	Singapore Telecom	0.013	0.001
Banks	DBS Group Holdings	<b>-0.016</b>	<b>0.027</b>
Travel and Leisure	ComfortDelGro Corporation	<b>0.022</b>	<b>-0.017</b>
<b>Panel D: Vietnam</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
Technology Hardware and Equipment	Mobile World Invest.	0.014	<b>0.023</b>
Fixed Line Telecommunications	FPT Corporation	-0.004	<b>0.029</b>
Travel and Leisure	Vietnam Airlines	<b>-0.024</b>	<b>-0.002</b>
Banks	Saigon Thu. Tin Commercial	<b>-0.021</b>	0.004
General Industrials	Hoa Phat group	0.024	<b>0.039</b>
Food Producers	Masan Group Corporation	0	<b>0.031</b>
Banks	Ho Chi Minh CTDEV. JST. CMLBK.	<b>0.067</b>	<b>0.035</b>
Personal Goods	Song Hong Garment	0.006	<b>-0.029</b>
Beverages	Siagon Beer- Alcohol- Beverage	<b>-0.041</b>	<b>-0.142</b>
Construction and Materials	Hoa Binh Construction Group	0.005	<b>0.064</b>
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Chemicals	Yen Bai Industry Mineral	<b>0.074</b>	<b>0.046</b>
General Retailers	Ben Thanh Trading & Service	<b>0.066</b>	<b>0.073</b>
Construction and Materials	Dong A Plastic Group	0.004	<b>0.009</b>
Industrial Transportation	Superdong Fast Fe. Kien Giang	-0.003	<b>0.017</b>
Construction and Materials	FLC Mining Investment	0.029	0.027
Industrial Transportation	Hai And Transport & STEVD.	0.017	<b>0.034</b>
Financial Services (Sector)	Viet Dragon Securities	0	<b>-0.073</b>
Mining	Fecon Mining	<b>0.03</b>	<b>0.025</b>
Industrial Metals and Mining	Son Ha Sai Gon	0	<b>0.027</b>
Health Care Equipment and Services	Japan Vtm. Med. Instrument	-0.021	<b>-0.075</b>
<b>Panel E: Thailand</b>			
<b>Sectors</b>	<b>Firms (Large)</b>	<b>AR</b>	<b>CAR</b>
Travel and Leisure	Minor International	<b>-0.116</b>	<b>-0.23</b>
Construction and Materials	SIAM Cement Public	-0.004	<b>0.034</b>
Food and Drug Retailers	CP All PCL	-0.007	-0.005
Health Care Equip. and Services	Bangkok Dusit Med. Svs.	<b>0.035</b>	<b>0.008</b>
General Industrials	Berli Jucker PCL	<b>0.042</b>	<b>0.128</b>
Banks	Bangkok Bank Limited	0.012	<b>-0.066</b>
Oil and Gas Producers	PTT	0.007	<b>-0.024</b>
Banks	SIAM Commercial Bank	<b>-0.024</b>	-0.007
-	CAL-COMP ELTN. (THAI.)	0.012	-0.005
Banks	Krung Thai Bank	0.004	-0.004
<b>Sectors</b>	<b>Firms (Small)</b>	<b>AR</b>	<b>CAR</b>
Electricity	Ratch Group PCL	<b>-0.022</b>	<b>0.083</b>
Electricity	Energy Absolute PCL	-0.006	<b>0.056</b>
Construction and Materials	Dcon Products	-0.009	<b>0.062</b>
Electricity	CK Power	-0.013	<b>0.041</b>
Gas, Water and Multiutilities	Eastern Water Resources Dev.& Man.	0.014	<b>-0.029</b>
Financial Services (Sector)	Eastern Coml. Leasing	0.023	<b>0.115</b>
Technology Hardware and Equip.	ALT Telecom PCL	-0.006	<b>0.086</b>
General Retailers	Autocorp Holding	<b>0.068</b>	<b>0.143</b>
General Retailers	FN Factory Outlet	<b>-0.052</b>	-0.001
Real Estate Investment and Services	Everland PCL	-0.014	<b>0.024</b>

Notes: March 18 is the date of sorting the AR and CAR values. ASEAN-6 to sort the firms based on their size (average of last five years market capitalization). Values in bold exhibit statistically significant values at 5% level of significance and better.



**Fig. 7.** The periodic networks of bilateral exports for ASEAN-6 and China, Japan, and South Korea. Note: The node shows the economy’s size, which is the average of these countries’ last five years’ GDP. The largest node shows the largest economy in the sample. The edge shows the magnitude of bilateral exports. The color scheme is as follows: The snow color shows the nodes and the size of node decides the size of the economy. The dark green colour shows the strongest spillover effect (edge) in the network, and the light green shows weakest relation. The degree of causal relationship goes down with the dark green to faded green. Country abbreviations are INDO: Indonesia, THAI: Thailand, VIET: Vietnam, KOR: South Korea, PHILI: Philippines, MALAY: Malaysia, JAP: Japan, SING: Singapore.

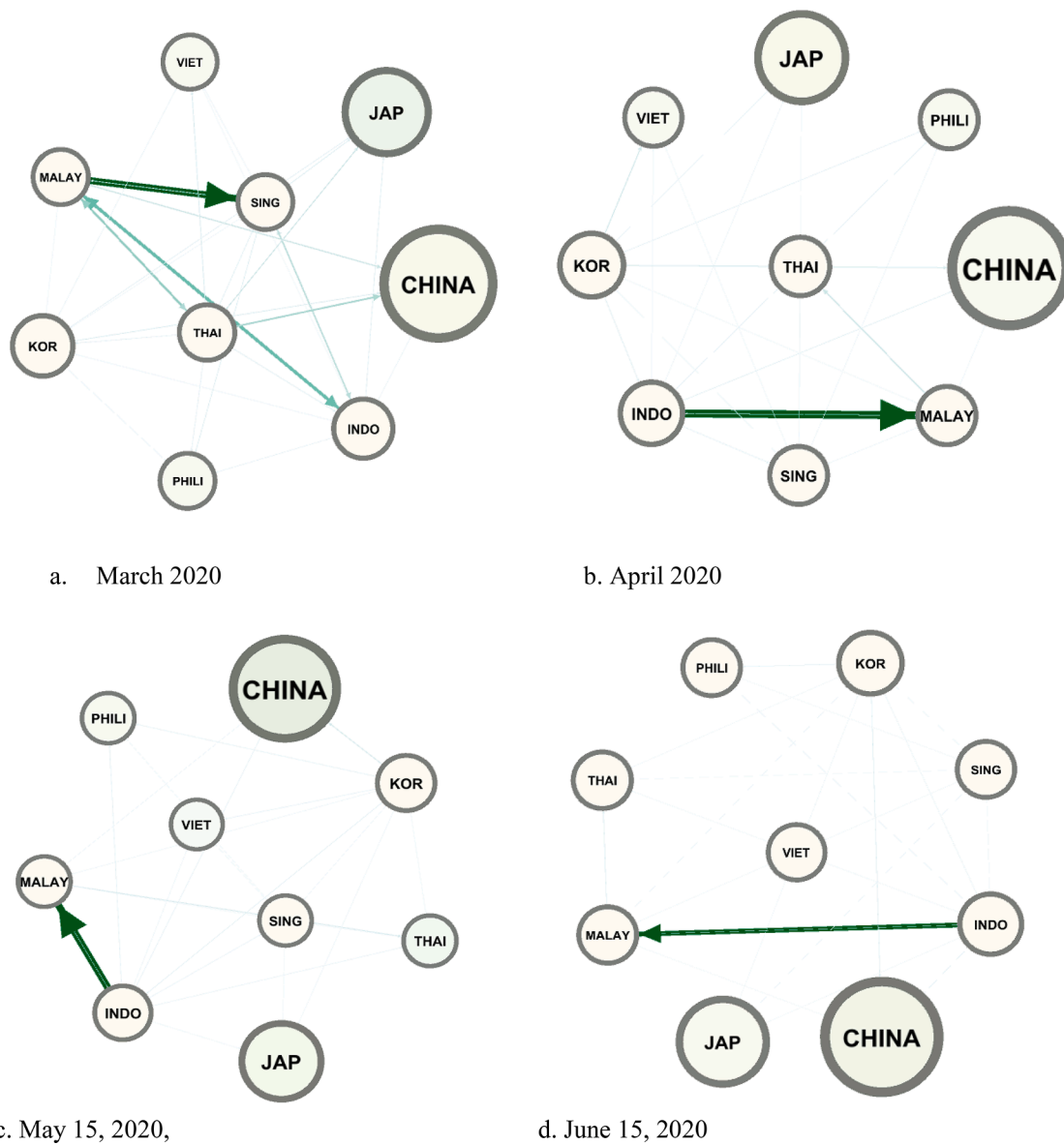
shocks and enhance the trade and investment scenarios (ASEAN, 2021). The support of smaller businesses and technology transfer in electronic and e-commerce. The Asian Development Bank (2022) has also identified five sectors, tourism, agriculture processing, garments, electronics, and digital trade, as key drivers of ASEAN+3 (Seng et al., 2021). The close economic ties of ASEAN-6 with China also justify the ‘*equidistant diplomacy*’ of ASEAN (Katsumata, 2021).

**5. Conclusion and policy implications**

The coronavirus pandemic has impacted ASEAN adversely. To measure the extent and spread of impact, it is crucial to examine the related events and their impact on the movements of key variables. The worst side of the coronavirus pandemic has been the stringency measures undertaken to curb the spread of the virus. Since ASEAN is a heterogeneous region with uneven growth and development, uniform impact analysis may not be suitable. Therefore, this study considers only six countries of ASEAN and aims to examine the impact of the

coronavirus pandemic on the critical indicators of economic integration and regional cooperation. The study adopts the time-series approach to conduct the study. At the aggregate level, the coronavirus outbreak seemed to have affected all economies uniformly. In March 2020, the outbreak struck all the economic activities; thus, the trade and tourism inflows were at the lowest, except for a few countries, including Indonesia and Malaysia. April onwards, the stringency measures were, to some extent, relaxed, resulting in bilateral trade among ASEAN nations. However, the subdued outlook of tourism sector remained the major cause of concern due to the rising number of cases and travel restrictions from China, Japan, and South Korea. The travel restrictions in China have also impacted the ASEAN-6 nations.

Overall, the aggregate and disaggregate analysis using trade and tourism and firm-level data provide sufficient insights into the pandemic’s implications on the region’s economic integration. The findings may also provide a valuable direction for trade, travel, and leisure firms. Policy experts should promote tourism so that some economies may have better employment generation opportunities. The causal networks



**Fig. 8.** The periodic networks of bilateral tourist arrivals for ASEAN-6 and China, Japan, and South Korea. Note: The node shows the economy’s size, which is the average of these countries’ last five years’ GDP. The largest node shows the largest economy in the sample. The edge shows the magnitude of bilateral tourists. The snow color shows the nodes and the node size decides the economy’s size. The dark green colour shows the strongest spillover effect (edge) in the network, and the light green shows weakest relation. The degree of causal relationship goes down with the dark green to faded green. Country abbreviations are INDO: Indonesia, THAI: Thailand, VIET: Vietnam, KOR: South Korea, PHILI: Philippines, MALAY: Malaysia, JAP: Japan, SING: Singapore.

find Vietnam and Singapore exhibiting a strong effect for directional dependence, suggesting the high intra-ASEAN economic integration and the economic dependence with China, Japan, and South Korea. However, trade networks’ results should be analysed cautiously as trade may have continued for healthcare and medical instruments. A detailed analysis could be conducted to discern the commodity-specific details during this period.

From policy points of view, the findings support the initiatives such as ‘Broad Strategies’ under ACRF, the ‘COVID-19 ASEAN Response Fund’, and ‘Special ASEAN Summit on Coronavirus Disease 2019 (COVID-19)’ (Shimizu, 2021). Chong, et al. (2021), Katsumata (2022), La and Miranti (2021), Taghizadeh-Hesary et al. (2022), and Purnomo et al. (2022) support the findings of this study in the context of ASEAN.

Methodologically, this study opens an interesting domain of cross-country analysis using the linear and non-linear time series. The outcomes of structural break models are appreciable as these models

capture the structural break appropriately.

This study’s major contribution is providing a firm-level perspective that may become a significant contribution. The Event-study analysis of large and small firms based on their size and employment potential suggests that the coronavirus pandemic has uniformly impacted large and small firms. However, the extent of the coronavirus impact differs across ASEAN-6. The major limitation of this study is the sample size. For time-series analysis, a longer time horizon is recommended. Future studies may incorporate further waves of the pandemic and explore structural break models requiring a larger dataset. Another limitation is deriving the policy inference from the stock market data. The main purpose of using stock market data is to capture the economy’s pulse, which is often considered a forward-looking indicator. Due to the paucity of high-frequency data on real sectors, the signaling process can be drawn from the stock price data. The availability of stock price data at the firm level helped add the dimension of firm-level analysis. Some

studies may also examine firms' non-systematic risk analysis to infer the impact of the pandemic. However, our results are unbiased and easily replicable for other economies.

### Declaration of Competing Interest

None.

### Acknowledgment

This research was conducted as a part of the project of Economic Research Institute for ASEAN and East Asia (ERIA) 'A Firm-level Analysis of the Impact of the Coronavirus Outbreak in ASEAN'. The earlier draft of this paper has appeared as ERIA's Discussion Paper Series No 397: <https://www.eria.org/publications/a-firm-level-analysis-of-the-impact-of-the-coronavirus-outbreak-in-asean/>. The opinions expressed in this paper are the sole responsibility of the authors and do not reflect the views of ERIA. The author acknowledges the opportunity and generous support provided by the Asian Economic Community Forum (ACEF). The authors are also thankful to the Editors of the journal, Josef Brada and Jehoon Park, for their excellent support. A special thanks to Ali M. Kutan for organizing this event.

### Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.aglobe.2022.100040](https://doi.org/10.1016/j.aglobe.2022.100040).

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