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Investor's behaviour to COVID-19 vaccination campaign; An event study and panel data analysis in the southeast asian region

Comportamiento de los inversores ante la campaña de vacunación COVID-19; un estudio de eventos y análisis de datos de panel en la región del sudeste asiático

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Abstract

This study examines how the COVID-19 immunization campaign has influenced the stock market responses in the WHO Southeast Asian Region. The effects of the immunization campaign on the WHO Southeast Asian countries were different, and the study used event study techniques and panel-data regression models to investigate the impact of the WHO South-East Asian capital market. Some countries like India, Sri Lanka, and South Korea had positive markets that responded to the news, while others did not. The findings of this study suggest that investors make fair assessments and respond to events and announcements, but they tend to have a more visible reaction to negative incidents than to positive news/events. However, after 51 days, the WHO South East region as a whole had internalized the encouraging news. The study has a few limitations, such as a small dataset and period, only a few variables and models, and so on. Future studies could include a few additional countries and periods to produce more significant results.

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Originality/value- This study contributes to the existing knowledge about the impact of drugs and vaccinations on stock markets. It is the first study to investigate how the WHO Southeast Asian Region's COVID-19 immunization program affects the stock market reaction. The study used keywords such as Immunization campaign, abnormal returns, Cumulative average abnormal returns, Event Study, and WHO Southeast Asian Region.

JEL Code: E44, G14, E33, G40
Keywords: immunisation campaign; abnormal returns; cumulative average abnormal returns; event study; WHO southeast asian region

Resumen

Este estudio examina cómo la campaña de inmunización COVID-19 ha influido en las respuestas del mercado de valores en la Región del Sudeste Asiático de la OMS. Los efectos de la campaña de inmunización en los países del sudeste asiático de la OMS fueron diferentes, y el estudio utilizó técnicas de estudio de eventos y modelos de regresión de datos de panel para investigar el impacto del mercado de capitales del sudeste asiático de la OMS. Algunos países como India, Sri Lanka y Corea del Sur tuvieron mercados positivos que respondieron a la noticia, mientras que otros no. Los hallazgos de este estudio sugieren que los inversores hacen evaluaciones justas y responden a eventos y anuncios, pero tienden a tener una reacción más visible ante incidentes negativos que ante noticias/eventos positivos. Sin embargo, después de 51 días, la región Sudeste de la OMS en su conjunto había interiorizado la alentadora noticia. El estudio tiene algunas limitaciones, como un conjunto de datos y un período pequeños, sólo unas pocas variables y modelos, etc. Los estudios futuros podrían incluir algunos países y períodos adicionales para producir resultados más significativos.

Originalidad/valor: este estudio contribuye al conocimiento existente sobre el impacto de los medicamentos y las vacunas en los mercados de valores. Es el primer estudio que investiga cómo el programa de inmunización contra la COVID-19 de la Región del Sudeste Asiático de la OMS afecta la reacción del mercado de valores. El estudio utilizó palabras clave como campaña de inmunización, resultados anormales, rendimientos anormales promedio acumulados, estudio de eventos y región del sudeste asiático de la OMS.

Código JEL: E44, G14, E33, G40
Palabras clave: campaña de vacunación; rendimientos anormales; rendimientos anormales promedio acumulados; estudio de eventos; región del sudeste asiático de la OMS

Introduction

The COVID-19 pandemic has had a significant impact on global financial markets (Al-Awadhi et al., 2020; Baker et al., 2020; Zaremba et al., 2020). In 2003, the SARS outbreak caused a significant decline in the stock market (Liu et al., 2005; Chen et al., 2009), but losses were limited to a short period, and consumer confidence and many stocks were eventually regained. The economic impact of SARS on affected communities and industries was direct, as the disease spread quickly across countries, affecting population

health and disrupting the economy due to commercial and financial ties between countries (Shang et al., 2021). H7N9 also caused significant financial losses, which had a spontaneous impact on stock markets (Sun, 2017). According to Bhuyan et al. (2010), after the epidemic, the dynamics of the Southeast Asian market shifted, indicating that SARS had a greater influence on Indonesia, Malaysia, Singapore, and Thailand than on the greater China Region.

Additionally, the Ebola outbreak has had a big influence on the stock prices of US and West African companies (Ichev and Marinc, 2018). With the disruption of global interconnection, emerging economies have suffered from decreased exports and a deteriorating tourism industry (Papanikos, 2020; Bodnar et al., 2020).

The World Health Organisation declared the COVID-19 outbreak a global pandemic on March 11, 2020 (Zhang et al., 2020). The pandemic had a negative impact on the stock market, according to various studies (Okorie and Lin, 2020; Ashraf, 2020; Al-Awadhi et al., 2020). The study undertaken by (Melati and Nurwulandari, 2020) demonstrated a predisposition for degradation across ASEAN stock markets because of the COVID-19 outbreak. Market interconnectivity shrank due to each country's independence and fluctuating response to the pandemic. (AlAli, 2020) looked into how the first confirmed incident affected financial markets in 11 different countries and concluded that the market has been extremely erratic. Overall, the economic hardship caused by COVID-19 has resulted in an improper drop in lower middle-income countries' growth (Goldberg and Reed, 2021), and the Southeastern regions are not immune to the same. To end the COVID-19 epidemic, fair access to safe and effective immunizations will be required.

Because one of the key forces promoting global growth is the Southeast Asian area. The only chance for growing immune systems is vaccination, as the world had never seen such a serious health crisis. Historically, global vaccination efforts have improved stock market responsiveness. Prior research in ten endemic countries discovered that dengue vaccinations can be very affordable and cost-effective in three to seven countries, depending on per capita GDP (Supadmi et al., 2019).

Similarly, (Corredor and Santamaria, 2021) analysed the relationship between FDA medicine approvals and pharmaceutical company stock prices. The authors discovered that positive FDA drug approval decisions had a significant beneficial impact on pharmaceutical company stock values. They also discovered that smaller and riskier businesses had a more significant market reaction to FDA clearance decisions. (Kumar et, al, 2020) investigated the effect of clinical trial results on biotech stock prices and discovered that promising clinical trial findings had a strong beneficial influence on biotech firm pricing. (Thanh and colleagues, 2020) evaluated the impact of vaccine announcement news on the stock market during the 2003 SARS outbreak. According to their analysis, news about vaccine announcements had a positive influence on the market, especially for the healthcare industry.

Global vaccine programs have exhibited a considerable immunization gap between developed and developing nations. Over 500 million doses have been provided worldwide, but it have mostly benefited the citizens of industrialized nations. In July 2020, more than 20 governmental and commercial organizations worldwide will compete to create the COVID-19 vaccine (World Health Organisation, 2020). After falling by 40%-50% during the COVID-19 pandemic epidemic in February and March 2020, the US stock market rebounded significantly within six months (Acharya et al., 2021).

(Chen et al., 2021) researched the stock market impact of immunity boosters. They found that firms involved in the development and marketing of immunity boosters experienced massive rises in stock prices during the spread of the COVID-19 pandemic. The growth in developed-country stock indexes remains better since they respond to vaccine development quicker than developing-country stock markets. This is because developed countries may find it easier to receive the Covid-19 immunisation than developing ones

Since WHO announced one common date for vaccination drives in Southeast Asian economies, this paper endeavours to test the impact of the same by applying an event study and panel date approach. The event study technique (Yamashita and Miura, 2019) is a prominent strategy in finance research that studies the influence of specific events on capital markets, such as the debut of an IPO or the revelation of a sudden event (Lodha and Soral, 2015; Fama, 1991).

The remaining portions of the study are organised as follows: Section 3 addresses data gathering and the appropriate model employed, and Section 2 reviews some key literature on the issue. The findings and discussion are presented in Section 4. The conclusion and its consequences for policy are covered in Section 5.

Literature review

Voluminous studies on the impact of the COVID-19 epidemic on the capital market have been conducted in the past. Many investigators (Okorie and Lin, 2020; Cao et al., 2020; Liu et al., 2021) examined the linkage between the COVID-19 pandemic and the capital market and established the affinity between the COVID pandemic and capital market. During the pandemic outbreak, many global equity markets responded swiftly and exhibited volatility (Ali et al., 2020; Ashraf, 2020; Lahmiri & Bekiros, 2020; Mzoughi et al., 2020; Zhang et al., 2020). According to (Kaplanski & Toll, 2010), substantial research studies suggest that "Negative mindsets" and anxiety may influence financial backers' decisions

The World Health Organisation (WHO) declared an International Public Health Emergency (PHEIC) on January 30, 2020, and a worldwide pandemic crisis on March 11, 2020, due to the increased occurrence of coronavirus cases. Financial markets experienced unprecedented volatility because the severity

of the disease was unknown, no treatment was completely effective to date, and even clinical tests were not being evaluated after more than 8 months, and it could take months or even years for investors to react (Baker et al., 2020).

In late 2020, Governments across globe initiated the large-scale immunization and gradually started relaxing the restrictions in response to the arrival of COVID-19 vaccines. Anticipating that the immunization campaign might transmit positive information to market participants, many researchers began to investigate the impact of vaccinations on the economy and stock market. (Rouatbi et al., 2021) investigated the influence of COVID-19 immunization on stock market volatility in 66 countries and revealed that broad inoculation campaigns help to stabilize global financial markets. (Oanh 2022) indicated that vaccination has a positive influence on the capital markets of emerging nations and a negative influence on well-advanced economies.(Zeren et al., 2023) examined the emergence of the COVID-19 vaccination and its impact on USA and Chinese capital markets and the findings suggested that the vaccination drive triggered the stock market prices in the U.S.A. and China. Researchers in the past investigated the impact of the vaccination drive on various sectors in the Australian China, and USA capital markets, and their findings demonstrate that the indices for medicines, food, energy, technology, retail, and healthcare sectors had substantial positive returns quickly following the announcement(Alam et al., 2021; Demir et al. 2021; Liu et, al, 2021). (Arreola et al., (2021) concluded in their research that vaccine-related news, such as vaccine approval and vaccination campaigns, positively impacted the stock prices of the healthcare, technology, and retail sectors in the US stock market.

An efficient market is a market where investors cannot generate consistent abnormal risk-adjusted returns because economic and social events influence the market return (Orléan 1989, 2008; Walter and Brian 2008).

According to (Brown and Warner, 1980) event studies that take a long-term view can provide crucial data on market efficiency. The panel data method blends the inter-individual differences and intra-individual variations (Hsiao et al., 1995; Nerlove, 2002; Hsiao et al., 1993, 1989). With panel data, the problem can be simplified by focusing on the subsample in which past data are observed (Arellano et al., 1999).

Thus, this paper employs an event study and panel data model to examine and quantify the abnormal influence of any political/economic event on security prices. The development trajectory of event studies has been reported in several reviews and summaries of the body of existing research (Harris et al., 2001; Krivin et al., 2003; Kong Cheung, 2011; Mair, 2012).

Though notable literature exists on examining COVID-19 and capital market association, insufficient investigation is conducted on examining the linkage between vaccination drive and capital

market especially in emerging nations. Thus, based on the previous literature gap, the author aims to examine the impact of such announcements on Southeast Asian index returns. Based on previous research, the following hypothesis has been framed.

H_0-There is a positive association between the stock market reaction and immunization campaign in the WHO Southeast Asian area.

H_1-There is no positive association between the stock market reaction and immunization campaign in the WHO Southeast Asian area.

Research design

Objectives

The World Health Organization announced that the vaccination program for Southeast Asian economies will begin on January 10, 2021. As a result, this study chose Southeast Asian economies to investigate the influence of the WHO Immunisation Campaign on WHO Southeast Asian region indices.

Sample selection and data

The author employed nine Southeast Asian economic indexes (sensitive and volatile sectors) for his analysis (Table I). The current study employed the event study approach developed by (Liu et al., 2020) to investigate how the WHO Immunisation Campaign affects various Southeast Asian economies. The intraday closing prices for a variety of industries were collected from August 1, 2019, to May 1, 2021, using the stock exchanges of Southeast Asian economies and the www.investing.com website (an open-access website that gives global index and stock values in real-time). Along with volume trading and Dow Jones data, vaccine dose information was also gathered from investing.com, the official WHO website, wsj.com, and investing.com. The full data set was examined using Stata and Microsoft Excel.

Table 1
Stock market indexes for WHO Southeast Asian region

Country	Abbreviation	Stock exchange
INDONESIA	JKSE	JAKARTA COMPOSITE INDEX
MALDIVES	MASIX	MALDIVES STOCK EXCHANGE
MYANMAR	YSX	YANGON STOCK EXCHANGE
BANGLADESH	DSEX	DHAKA STOCK EXCHANGE BROAD
SRI LANKA	CSE	COLOMBO IND ALL SHS
SOUTH KOREA	S11	KOSPI COMPOSITE INDEX
INDIA	BSESN	S&P BSE SENSEX
NEPAL	NEPSE	NEPAL STOCK EXCHANGE
THAILAND	SET.BN	THAILAND SET INDEX

Sources: compiled by author by using Excel.

The methodology and empirical methods

This paper uses an event study method which is one of the most often used techniques for determining how a specific event affects stock returns over time (Anwar et al., 2017; Lyon & Barber, 1993; Brown & Warner, 1980). The event study approach was utilized by the majority of previous researchers to investigate the influence of a non-corporate event, such as a widespread epidemic, on capital markets (Bhattacharya et al., H. 2002; Chen et al.,2017,2018; McWilliams et al., D.1997; Liu et al., 2020; Pendell & Cho, 2013). Panel data can provide more accurate conclusions of model benchmarks and more simple statistical conclusions. (Hsiao, 1985; Baltagi, 2008; and Wooldridge, 2010). This research also intends to create a prediction model using panel data analysis that investigates the link between aberrant trading volume, vaccine dosages, index return, market return, and Ars (Hsiao, 2003; Hausman 1978)

The three regression models cannot be applied together. Hence, it is required to find out which estimation model would be perfect for the chosen dataset. The Redundant Fixed Effect or Liklihood Ratio is adopted to test the heterogeneity and the Hausman Test is applied to test the best model fit between Fixed and Random Effect.

In this study, the market model and ordinary least squares (OLS) regression are utilized to estimate the anticipated return, which is as follows:

$$R_t = Ln\frac{P_t}{P_{t-1}} \tag{1}$$

$$R_{i,t} = \alpha_{i,} + \beta_{i,} + \varepsilon_{i,t} \tag{2}$$

Here, $R_{i,t}$ is the return for country-specific index i at the time t , R_{mt} is the market return on the day t (where the event day is 0) for the given estimation window and $\varepsilon_{i,t}$ is the error term. The following formula has been used to calculate the expected return

$$E(R_{i,t}) = \alpha_{i,} + \beta_{i,} R_{m,t}$$

(3)

Equation (4) describes the process used for determining the anomalous return (AR) after calculating the expected return for each day for each nation-specific index.

$$AR = R_{i,t} - E(Ri, t)$$

(4)

Equation (5) demonstrate the calculations for cumulative abnormal return (CAR) of country specific index i over a window from t_0 to t_1

$$CAR_i = \sum_{t=t0}^{t_1} AR_{i,t}$$

(5)

Equation (6) explains the formula used to calculate average abnormal returns (AAR). For each event day, the numerical mean of ARs for all national indices is calculated. The number of indexes is denoted by the letter N.

$$AAR_{i,t} = 1/N \sum_{i=t}^{N} AR_{i,t}$$

(6)

To further determine and evaluate the event's cumulative influences, cumulative average abnormal returns (CAARs) are estimated. For the predefined event window (t0 - t1), CAAR represents the sum of daily AARs, and Equation (7) defines the computing method.

$$CAAR(t_{0,}t_1) = \sum_{t=t0}^{t_1} AAR_{i,t}$$

(7)

Event of interest and event date

Since WHO announced one common date i.e. January 10, 2021, hence, the objective of this research is to look at how the WHO Immunisation Campaign affected stock indexes in the WHO Southeast Asian area. One of the work's aims is to develop a prediction model that investigates the association between atypical trading volume, vaccination doses, index return, market return, and ARs. An event window of 80 days has been chosen to examine the lockdown's influence on sectoral indices, including the day of the announcement and the 79 days that followed the publication of vaccination push information.

To examine the short-term volatility and return due to Immunisation Campaign, the whole event window was divided into six event windows: (0–9), (10–19), (20–29), (30–39), (40–49), (50–59), (60–69), and (70–79).

Estimation window and model

Figure No. 1 shows the estimation window, which corresponds to the day before the event day when the Immunisation Campaign is launched on various periods , is between day -150 and day -1, per earlier studies (Lalwani et al. (2019); Anwar et al., 2017). Thus, the forecast's time frame is 150 trading days.

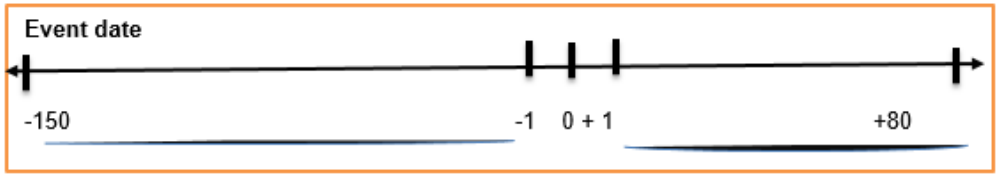

Figure 1. The period for the Event Study.

Results and discussion

Table 2 shows the standard deviation and mean before the occurrence in section (A) and the standard deviation and mean after the event in section (B). Aside from MASIX, all of the nation indices exhibited positive mean returns before the announcement of the vaccine deployment. The mean returns from the indices are negative in four cases (JKSE, YSX, DSEX, and CES), but positive in the other five, with lower standard deviations than before the announcement. This means that volatility in the stock market has diminished. The

means of the JKSE, KS11, and SET.BT plummeted almost to zero, showing that the movement of these indices following the introduction of the vaccination has been more neutral.

Table 2
Difference in mean return of selected sample for Southeast Asian Economies

Index	Trading Days	Group's Mean	Group's St Dev.
Part A: Pre-event time from 1 August 2019 until 10 January 2021			
JKSE	150	0.0021	0.0121
MASIX	150	-0.0005	0.0191
YSX	150	0.0000	0.0108
DSEX	150	0.0024	0.0080
CSE	150	0.0338	0.3757
KS11	150	0.0035	0.0117
BSESN	150	0.0023	0.0101
NEPSE	150	0.0047	0.0191
SET.BN	150	0.0009	0.0130
Part B: Post - event period from 10-01-2021 to 01-05-2021			
JKSE	80	-0.0006	0.0098
MASIX	80	0.0002	0.0022
YSX	80	-0.0037	0.0130
DSEX	80	-0.0002	0.0116
CSE	80	-0.0590	0.5159
KS11	80	0.0000	0.0122
BSESN	80	0.0002	0.0101
NEPSE	80	0.0046	0.0138
SET.BN	80	0.0001	0.0083

Sources: compiled by author by using excel.

Table 3 depicts the abnormal returns on the event day and the next day. Except for NEPSE, which recorded a negative AR of -0.02, stock markets in 8 of the 9 countries surveyed showed a positive AR ranging from 0 to 4.61 on the event day. We also reported the adverse reactions the day after WHO introduced the immunization. Except for the YSX and CSE stock indexes, all country indices registered a positive AR on t_1. Transactions ended on t1 as the AR of around four of the nine countries chosen for examination fell below zero, reflecting the market's uncertainty. The Danish stock exchange, CSE, had a positive 4.61 AR on the t_0 day, but it plunged to -4.02 on the t_1 day, showing substantial market volatility due to the country's geographic closeness.

Table 3
Abnormal return on the event date and one day after the event in WHO Southeast Asian Economies

	Abnormal Return	
Country Specific Index	Event date (t_0)	One day after the event (t_1)
JKSE	0.0101	0.0202
MASIX	0.0001	0.0003
YSX	0.0024	0.0101
DSEX	0.0105	0.0203
CSE	4.6101	4.6203
KS11	0.0402	0.0005
BSESN	0.0101	0.0103
NEPSE	-0.0202	0.0002
SET.BN	0.0003	0.0031

Sources: compiled by author by using excel.

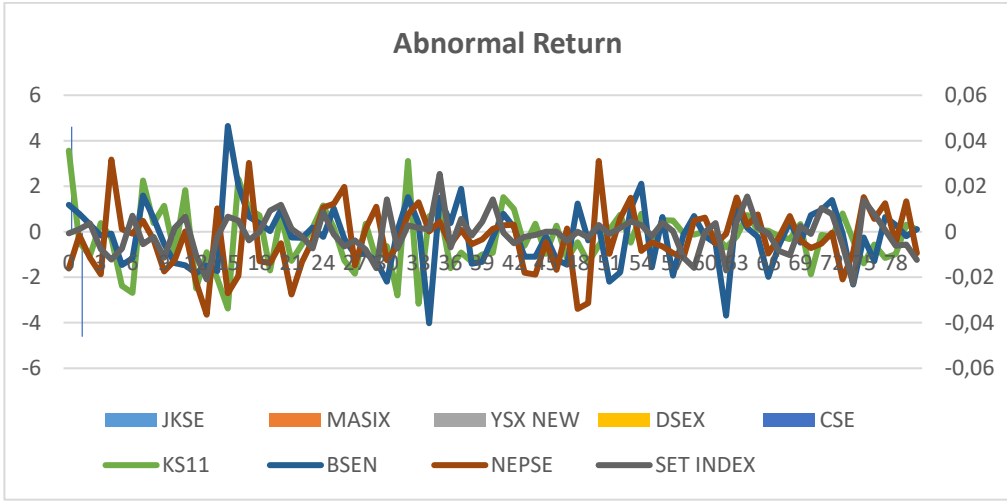

Figure 2. Abnormal return of WHO Southeast Asian Countries (0–79).

In the WHO South East Asian nations, the CAR is determined by adding the daily abnormal returns for the nations evaluated for the study's indices (see Tables 4-11). The CAR for the WHO Southeast Asian Countries stock market indexes is shown in Table 4 for days 0 through 9. Despite the fact that the event's nature was intended to have a favorable influence on markets, the YSX, CSE, NEPSE, and SET BN indexes showed negative returns in the first 10 days of the whole event period. The SET.BN declined by 4.7% over this event period, the most of any country's index, and this is significant at the 1% level. India, Dhaka, and Jakarta were the least affected during the event timeframe (0-9).

Table 4
Cumulative abnormal return for the event window (0-9) for South Asian Economies

Country specific Index	CAR (0-9)	t- statistic
JKSE	0.0204	0.0476
MASIX	0.0112	0.0284
YSX	-0.0022	0.0059
DSEX	0.0081	0.0268
CSE	0.0087	-0.2880
KS11	-0.056	0.0266
BSESN	0.0106	0.0218
NEPSE	-0.0319	-0.0858
SET.BN	-0.0350	-0.1027

Note- CAR stands for Cumulative abnormal return..
CAR is statistically significant at *p<0.10, **p<0.05, and ***p<0.01.
Source- (Author's compilation using Excel).

The performance of the WHO Southeast Asian stock market after 10 days of the new immunizations is depicted in Table 5. During this event window (10-19), prominent market indices dropped and succumbed to the constraints of COVID-19 immunization. The significant damaging CARs for YSX, DSEX, and KS11 were 0.034%, 0.0783%, and 0.056%, respectively. The striking feature is that the returns moved to a high negative from a neutral CAR value in just ten days. JKSE, CSE, NEPSE, and SETBT all saw decreases, albeit to varying degrees, with CARs of - 0.0696%, - 0.13427%, - 0.1034%, and - 0.0083%, respectively.

Table 5
Cumulative abnormal return for the event window (10-19) for South Asian Economies

Country-specific Index	CAR (10-19)	t- statistic
JKSE	-0.0696	-0.1622
MASIX	-0.0002	-0.0006
YSX	-0.0344	-0.1057
DSEX	-0.0783	-0.2533
CSE	-0.1342	-0.4058
KS11	-0.0560	-0.1700
BSESN	-0.0013	-0.0026
NEPSE	-0.1034	-0.0298
SET.BN	-0.0083	-0.0242

Sources: compiled by author by using excel.

Table 6 shows how the WHO Southeast Asian stock market performed following 10 days of new immunizations. Major market indices dropped and succumbed to COVID-19 vaccine restrictions throughout this event timeframe (20-29). The most remarkable element is that the returns jumped from a neutral CAR

value to a high negative value in just 10 days. JKSE, CSE, NEPSE, and SETBT all saw reductions except for MASIX.

Table 6
Cumulative abnormal return for the event window (20-29) for South Asian Economies

Country-specific Index	CAR (20-29)	t- statistic
JKSE	-0.0160	-0.0368
MASIX	0.0002	0.0101
YSX	-0.0103	-0.0298
DSEX	-0.0467	-0.1463
CSE	-0.0434	-0.1215
KS11	-0.0356	-0.1056
BSESN	-0.0145	-0.0347
NEPSE	-0.0018	-0.0136
SET.BN	-0.0159	-0.0674

Sources: complied by author by using excel.

Table 7 displays CARs for global economic indices in the event window (30-39). Market responses varied across indices at this time, and the industrial sectors suffered significantly as a result of lingering concerns about the vaccine's efficacy or capacity. Companies in the healthcare sector also became cautious, which caused the stocks to fall to such low levels. During this focused event window, all indexes registered a significant negative CAR. During this event window, the NEPSE and JKSE indexes fell by -0.0102 and -0.0035, respectively, while the DSEX and SET indices climbed.BT saw positive growth on a scale of 0.02 to 0.04.

Table 7
Cumulative abnormal return for the event window (30-39) for WHO South Asian Economies

Country-specific Index	CAR (30-39)	t- statistic
JKSE	-0.0035	-0.0005
MASIX	0.0001	0.0023
YSX	0.0031	-0.0121
DSEX	0.0165	0.0467
CSE	0.0006	0.0123
KS11	-0.0657	-0.1204
BSESN	-0.0301	-0.0646
NEPSE	-0.0102	-0.0203
SET.BN	0.0432	0.1102

Sources: compiled by author by using excel.

All indices showed more significant return drops during the event window (40-49), making the public more wary about the stock market's future performance. The fact that there was no significant decline in the number of cases or scaling of vaccine availability across continents was the factor that drove many to

lose faith inspired by the vaccine's debut. The indexes of the JKSE, DSEX, KS11, and BSESN all dropped severely, with CARs ranging from -0.08% to -0.06%, and -0.02% to -0.03%, respectively.

Table 8
Cumulative abnormal return for the event window (40-49) for South Asian Economies

Country-specific Index	CAR (40-49))	t- statistic
JKSE	-0.08	-0.19
MASIX	0.00	-0.01
YSX	0.00	0.02
DSEX	-0.06	-0.19
CSE	0.02	0.07
KS11	-0.02	-0.07
BSESN	-0.03	-0.07
NEPSE	-0.11	-0.31
SET.BN	0.00	0.00

Sources: compiled by author by using excel.

Table 9 gives indications of future stock market declines across the global economy in terms of CAR in the event window (50-59). After almost two months of vaccination announcements, the actual restrictions emerged, with the logistical needs of being transported at zero degrees Celsius emerging as essential requirements to achieve delivery standards. Such logistical requirements, along with the production cost of the vaccine, were one of the biggest challenges across countries. In the worldwide pretext, almost all indexes had negative CARs. The JKSE, YSX, DSEX, CSE, BSESN, and SET.BT all had severely negative CARs of -0.01%, -0.02%, -0.04%, -0.09%, -0.03%, and -0.01%, respectively. The MASIX, KS11, and NEPSE indexes saw positive returns during this period to the tune of 0.02 percent, 0.01 percent, and 0.01 percent, respectively. This increase was not driven by global improvements in vaccine reach, but rather by a simple positive retraction of the indices caused by recent negative movements.

Table 9
Cumulative abnormal return for the event window (50-59) for Southeast Asian Economies

Country-specific Index	CAR (50-59)	t- statistic
JKSE	-0.01	-0.015
MASIX	0.02	0.06
YSX	-0.02	-0.08
DSEX	-0.04	-0.12
CSE	-0.09	-0.26
KS11	0.01	0.02
BSESN	-0.03	-0.06
NEPSE	0.01	0.02
SET.BN	- 0.01	-0.04

Sources: compiled by author by using excel.

Table 10 displays CAR and T statistics for all indices from days 60 to 69. According to Table 10, CAR decreased from day 60 to day 69 as investor apprehension increased as a result of COVID-19's global spread. After a reasonable period of 70 days, there was no positive effect of the vaccination, with important stock markets such as BSESN and CSE still showing losses of -0.06% and -0.02%, respectively, suggesting that the percentage losses are significant in terms of the general functioning of the economy.

Table 10
Cumulative abnormal return for the event window (60-69) for Southeast Asian Economies

Country-specific Index	CAR (60-69)	t- statistic
JKSE	-0.01	-0.01
MASIX	0.01	0.01
YSX	-0.01	-0.02
DSEX	-0.01	-0.02
CSE	-0.02	-0.05
KS11	-0.06	-0.07
BSESN	-0.06	-0.12
NEPSE	0.02	0.04
SET.BN	-0.01	-0.02

Sources: compiled by author by using excel.

According to Table 11, the indices climbed by a considerable margin, securing positive margins in the vast majority of circumstances. This was also the moment when Europe began to explore alternatives that had a higher chance of success and were less expensive to treat. The DSEX gained by 0.0075% over this period, followed by the MASIX indices, which rose by 0.0059%. The BSESN, NEPSE, and SET.BT indexes, on the other hand, had no movement in their levels and so reported a 0% return during the 10 days. The CSE, JKSE, YSX, and KS11 indices all indicated negative returns indicating that despite the immunisation being announced 80 days ago, the market has not responded.

Table 11
Cumulative abnormal return for the event window (70-79) for South Asian Economies

Country specific Index	CAR (70-79)	t- statistic
JKSE	-0.04	-0.09
MASIX	0.006	0.02
YSX	-0.01	-0.03
DSEX	0.008	0.02
CSE	-0.027	-0.08
KS11	-0.06	-0.07
BSESN	0.00	0.00
NEPSE	0.00	0.00
SET.BN	0.00	0.00

Table 12
AARs and CAARs of country-specific Index in WHO Southeast Asian Economies

Day	AAR	AAR t Stat	CAAR	CAAR t Stat	Skewness	Kurtosis
0	-0.5089	-0.7101	0.8005	0.8005	0.0697	1.5016
1	-0.0061	-0.0085	0.7580	0.7580	-1.7316	3.9988
2	-0.0015	-0.0021	0.7459	0.7459	-0.9439	-1.0798
3	-0.0030	-0.0042	0.7238	0.7238	-1.4958	1.7581
4	-0.0098	-0.0135	0.6587	0.6587	-0.5942	1.0787
5	0.0014	0.0020	0.6657	0.6657	0.1319	-1.9900
6	-0.0045	-0.0061	0.6353	0.6353	-1.5761	0.2709
7	0.0025	0.0034	0.6491	0.6491	-0.2325	-2.1806
8	-0.0007	-0.0010	0.6426	0.6426	-0.7418	-2.7233
9	-0.0062	-0.0084	0.6021	0.6021	1.4046	1.8410
11	-0.0050	-0.0068	0.5692	0.5692	-1.6242	-1.1914
12	-0.0144	-0.0195	0.4790	0.4790	0.1846	-1.0880
13	-0.0101	-0.0135	0.4163	0.4163	-0.2516	0.6760
14	-0.0064	-0.0085	0.3766	0.3766	1.2194	1.4220
15	-0.0115	-0.0154	0.3063	0.3063	0.7374	-2.3193
16	0.0023	0.0031	0.3191	0.3191	-0.9861	-0.8760
17	0.0089	0.0118	0.3712	0.3712	0.0695	-1.5329
18	-0.0040	-0.0053	0.3463	0.3463	1.4177	1.7653
19	-0.0076	-0.0100	0.3009	0.3009	-0.3358	0.5038
20	-0.0012	-0.0016	0.2928	0.2928	-0.0430	0.3025
21	0.0050	0.0065	0.3208	0.3208	0.9301	2.1554
22	-0.0044	-0.0057	0.2948	0.2948	1.5788	-4.7099
23	-0.0029	-0.0038	0.2770	0.2770	1.4831	-5.2323
24	0.0031	0.0040	0.2938	0.2938	-1.6266	-5.5415
25	0.0040	0.0052	0.3155	0.3155	-1.6484	-2.8904
26	-0.0038	-0.0049	0.2933	0.2933	0.6770	1.8650
27	-0.0086	-0.0111	0.2440	0.2440	-1.7314	-4.5552
28	-0.0038	-0.0048	0.2224	0.2224	1.1507	-0.9014
29	-0.0073	-0.0093	0.1814	0.1814	0.2972	-2.1754
30	-0.0057	-0.0073	0.1493	0.1493	0.9419	2.1260
31	-0.0025	-0.0032	0.1350	0.1350	1.3105	-0.4099
32	0.0073	0.0093	0.1747	0.1747	0.5928	-0.4052
33	0.0014	0.0018	0.1819	0.1819	-0.2392	-0.2490
34	-0.0056	-0.0071	0.1511	0.1511	-0.4601	-0.4867
35	0.0066	0.0083	0.1859	0.1859	1.1435	-0.4436
36	-0.0021	-0.0027	0.1741	0.1741	0.5775	-0.4528
37	0.0014	0.0017	0.1809	0.1809	0.4062	1.3931
38	-0.0048	-0.0060	0.1551	0.1551	1.1970	-3.6629
39	-0.0031	-0.0039	0.1383	0.1383	0.9106	-3.7846
40	0.0002	0.0003	0.1391	0.1391	-1.3990	2.6567
41	0.0012	0.0014	0.1447	0.1447	-1.3801	2.9966
42	0.0014	0.0018	0.1518	0.1518	-1.7150	-3.8129
43	-0.0038	-0.0047	0.1320	0.1320	0.9585	1.9988
44	-0.0021	-0.0025	0.1210	0.1210	-1.6039	-3.3620
45	-0.0018	-0.0022	0.1116	0.1116	-1.6779	-5.8668
46	-0.0048	-0.0059	0.0869	0.0869	1.7317	-5.7953
47	-0.0049	-0.0059	0.0621	0.0621	1.7316	1.7234
48	-0.0021	-0.0026	0.0513	0.0513	0.5692	-2.2043
49	-0.0067	-0.0082	0.0175	0.0175	-1.0601	-3.6524
50	-0.0001	-0.0001	0.0170	0.0170	1.3626	-2.2137
51	-0.0088	-0.0106	-0.0264	-0.0264	-0.8810	0.5762
52	-0.0031	-0.0037	-0.0416	-0.0416	-0.3591	0.7027
53	0.0014	0.0017	-0.0347	-0.0347	-0.7142	-1.8613

54	-0.0003	-0.0004	-0.0361	-0.0361	-1.3279	-4.7485
55	-0.0057	-0.0068	-0.0635	-0.0635	1.6570	-4.0980
56	-0.0051	-0.0061	-0.0879	-0.0879	1.6961	3.6814
57	0.0020	0.0024	-0.0782	-0.0782	1.6912	0.3089
58	-0.0046	-0.0054	-0.0998	-0.0998	0.6690	0.9527
59	-0.0020	-0.0024	-0.1092	-0.1092	-1.2018	-4.6263
60	-0.0011	-0.0013	-0.1141	-0.1141	-1.2035	-2.6607
61	-0.0046	-0.0054	-0.1355	-0.1355	0.8439	-0.3354
62	-0.0065	-0.0077	-0.1656	-0.1656	1.5154	-1.6763
63	0.0041	0.0049	-0.1459	-0.1459	-0.5198	1.2594
64	-0.0003	-0.0003	-0.1468	-0.1468	1.4803	2.8043
65	-0.0013	-0.0015	-0.1524	-0.1524	-1.0259	1.3483
66	0.0002	0.0003	-0.1510	-0.1510	-1.6897	3.8340
67	0.0004	0.0004	-0.1490	-0.1490	1.4578	3.1738
68	0.0002	0.0002	-0.1478	-0.1478	-1.3645	1.9833
69	-0.0004	-0.0004	-0.1492	-0.1492	-1.2106	2.7268
70	-0.0019	-0.0022	-0.1575	-0.1575	-1.4637	3.3766
71	0.0000	0.0000	-0.1572	-0.1572	-1.5615	-5.5279
72	-0.0003	-0.0004	-0.1582	-0.1582	-1.5481	3.3016
73	-0.0019	-0.0022	-0.1662	-0.1662	-1.5455	2.4457
74	-0.0097	-0.0112	-0.2090	-0.2090	-1.0074	2.3357
75	0.0018	0.0020	-0.2007	-0.2007	-1.0021	1.0795
76	-0.0019	-0.0022	-0.2086	-0.2086	-1.1397	-4.4597
77	0.0033	0.0038	-0.1937	-0.1937	1.6969	1.5404
78	-0.0023	-0.0027	-0.2034	-0.2034	0.8227	1.9790
79	-0.0003	-0.0004	-0.2044	-0.2044	-1.7140	-1.1401
80	-0.0002	-0.0002	-0.2048	-0.2033	-0.2001	-0.1083

Notes: EW is for event window; AAR stands for average abnormal return; and CAAR stands for cumulative average abnormal return. *p<0.10, **p<0.05, and ***p<0.01 for AAR and CAAR, respectively.
Sources: complied by author by using excel.

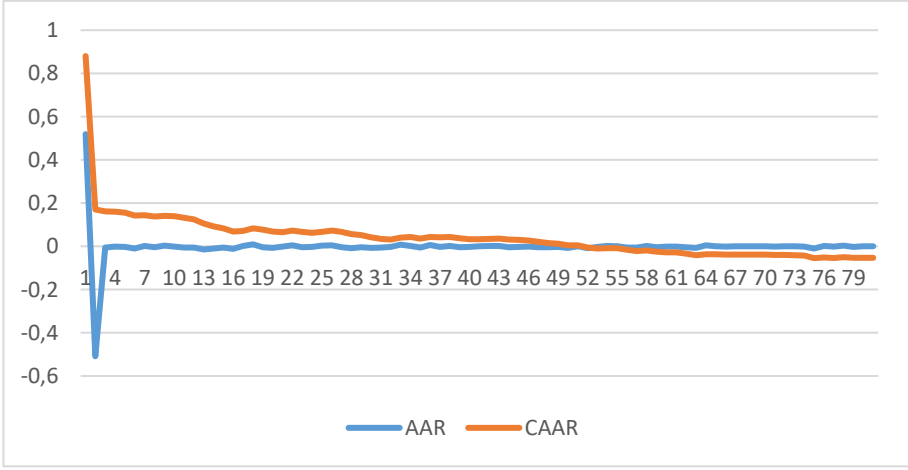

Figure 3. From Day 0 to Day 80, AAR and CAAR.
Source: Author's compilation using Excel.

To examine the anomaly in return of the index after the WHO's immunization announcement, a panel regression analysis is applied. We utilize the index's AR as the dependent variable and the indices' daily returns as the independent variables, with the return of the market index, vaccination doses, and anomalous trading volume serving as AR regressors. (Eli and Richardson, 2000; Bradley et al. 2002; Field et al 2001; and Eli and Richardson 2000) all found a strong relationship between trade volume and ARs associated with company-specific events. Market stress is indicated by high trade volumes and decreasing stock markets. As a consequence, in line with earlier research, we incorporate anomalous transaction volume in our panel regression model. The panel data set contains a dimension of time (80: trade days t = 0, 1, 2,..., 80) following D-day, vaccination introduction, and 150 days before vaccine announcement, as well as a cross-sectional dimension (9 WHO southeast Asian county-specific indicators). 720 observations to study the link between the dependent and independent variables.

Table 13
Descriptive Statistics

Variable	Count	Mean	Std. Dev	Min	Max
Ab_Ret	720	-0.0020	0.0119	-0.0604	0.0643
Ln_vaccination	720	0.0874	0.8287	-6.8002	7.0048
Retrun_index	720	2.3245	0.01191	-0.0615	0.0746
Return_market	720	0.0011	0.0077	-0.0207	0.0193
Ab_Trading	720	-0.0494	1.2904	-5.0751	7.3326

Sources: compiled by author by using excel.

Panel data regression

$$ARi,t = \alpha + \beta_1\, Ln\_vaccination_{i,t} + \beta_2\, \text{Return\_Index}_{i,t} + \beta_3\, \text{Return\_market}_{\,i,t} + \beta_4\, \text{Ab\_Trading}_{\,i,t}$$

Where Return Index is the daily return of the Southeast Asian indexes, return Market is the daily return of the Dow Jones Global Index corresponding to the economy index i on day t, and Ab_Trading is abnormal trading volume corresponding to the economy index i on day t. Ln_vaccination serves as the starting point for the regression, followed by return index, return market, and finally Ab_Trading.

The Pooled regression model outcome shows (Corresponding value of F-stats) that the model is significant [Refer to Annex A1. On the other hand, Annex A2 Demonstrates the Fixed Effect Model with similar findings. Nevertheless, the Random Effect Model indicates that the countries have a common mean value for the intercept. Three regression models i.e. the Pooled regression, Fixed effect, and Random Effect Model cannot be applied together. Hence, it needs to find out which one would be perfect for the chosen

dataset. The study employed the Redundant Fixed Effect or Likelihood Ratio to examine the heterogeneity and find the best suitable model between fixed and pooled regression.

Table 14
Redundant Fixed Effect Test

Effects Test	Statistic	df.	Prob.
Cross-section F	2.919822	(8,626)	0.0033
Cross-section Chi-square	23.409576	8	0.0029

Sources: compiled by author by using E-views.

The result given in Table 14 indicates that the corresponding probability value of Cross-section F and Cross-section Chi-square are less than 0.05 which indicates that the Fixed Effect Model is the best in comparison to the Pooled Least Square Model, however, it is important to note that even though the intercept is varying across the countries but it is constant over time. Hence Hausman test was conducted to examine the most suitable model.

Table 15
Hausman Test

Test Summary	Chi-Sq, Statistic	Chi-Sq.df	Prob.
Cross-section random	0.000000	4	1.0000

* Cross-section test variance is invalid. Hausman statistic set to zero
Sources: compiled by author by using E-views.

As per Hausman test results given in Table 15, the Random Effect Model should be the best suitable model. Another justification for selecting this regression model is not all the country's indices have been chosen and it has been assumed that differences in intercept are due to the randomness of the sample.

The results of the panel regression are shown in Table 16, and they demonstrate a significant association between the supplied independent variable and an anomalous return across all nations in the given area using a random effect model. The results in Table 16 support the notion of investor sentiment and are consistent with those of the event study. The positive global index shows that countries in WHO South East Asia are monitoring the global index in the wake of the immunization campaign.

Table 16
Abnormal return performance

Factors	1st AR	2nd AR	3rdAR	4th AR
Fixed	-0.00214	-0.00214	-0.00231	-0.00230
	(-4.7900)	(-6.3789)	(-6.8311)	(-6.7881)
Ln_vaccination	0.0007	0.0005	0.0006	0.0006
	(1.3557)	(1.3753)	(1.5017)	(1.5482)
Retrun_index		0.6582	0.6598	0.6592
		(23.584)	(23.783)	(23.759)
Return_market			0.1348	0.1335
			(3.1531)	(3.1213)
Ab_Trading				0.0002
				(1.0281)
R-Squared	0.0025	0.4382	0.4459	0.4468
N	720	720	720	720

Sources: compiled by author by using Eviews.

Conclusions

The COVID-19 epidemic has caused widespread destruction, and everyone has hunted for a cure and a vaccine. On January 10, 2021, the WHO launched an immunisation drive for the WHO South East Asian region. The immediate financial repercussions of the COVID-19 vaccination drive may be felt via stock market movements. The possibility of a decline in COVID cases and recovery from this pandemic illness is encouraged by vaccination (Apergis et al., 2022).

The results of the study are comparable to previous research findings. (Ibrahim et al. 2020) investigated the affinity among government response measures, COVID-19, and capital market volatility for 11 affluent and developing economies in the Asia-Pacific economies, and their findings indicated that, except Japan, all of the sample countries experienced low volatility over the short term. In G-20 countries, COVID-19 showed a negative anomalous return (Singh et al., 2024).

The findings of the study show that the Southeast Asian region's reaction to the COVID-19 immunisation attempt offer had a mixed reaction to the immunization doses. However, as the event window extended, the stock indexes of a few countries in the region began to show a gradual positive response to the immunization effort. (Izzahdi H and Suryani A, 2023) investigated the effect of COVID-19 vaccination and stringent government policies on stock market volatility in ASEAN countries, and their findings concluded that mass vaccination harmed stock market volatility, whereas stringent government policies had a positive effect. Findings from panel data regression demonstrate a favourable link between abnormal returns and other independent variables that show a positive change after the vaccination push.

Overall, the study's findings show that the vaccination campaign had a mixed impact on the WHO Southeast Asian region. Some established markets, including India, Sri Lanka, and South Korea, reacted to

the news immediately, while others exhibited a slow apparent link to the vaccination effort. The findings of the article suggest that investors make reasonable decisions and react to events and announcements.

The article has theoretical implications for both academics and policymakers. The present study might be used by regulators and scholars to measure market sentiment following favourable news. The study has applications for policymakers who want to assess stock market investor moods and reassure investors. Since it shows how stock markets react immediately to the news of a pandemic drug or vaccine, the study may also be valuable to investors, managers, and financial analysts.

The study provides practical implications for investors and market participants Investors, financial experts, and governments interested in the economic effects of the COVID-19 vaccine will find the study's conclusions valuable. This research will teach investors about fresh opportunities for anomalous gains and hedging strategies. By employing efficient hedging or safe-haven tactics to shield equity portfolios from sudden events and making wiser investment decisions to avoid enormous unanticipated losses, investors may profit from this sort of occurrence (Conlon and McGee, 2020).

The research does have some flaws, though. Future researchers may add other countries and large datasets; the author's research was restricted to the WHO South East Asia region. Future researchers may also investigate how industrialized and developing nations' stock markets responded to any such incident or statement.

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Annex

Table A1
Pooled ordinary least square (Annex)

Variable	Coefficient	Std. Error	t-Statistic	prob.
Constant	-0.002710	0.000365	-7.426400	0.0000
Vaccination_Data_of country	0.000842	0.000428	1.966511	0.0497
Stock_Exchange_Lnreturn	0.088334	0.028908	23.04984	0.0000
Dow_Jonesdaily_Closing index	0.1506B4	0.044B83	3.349826	0.0009
Tradingvolume_of country	0.000421	0.000294	1.431900	0.1527

R-squared	0.465473	Mean dependent var	-0.002899
Adjusted R-squared	0.462100	S.D. dependent var	0.011836
S.E. of regression	0.008682	Akaikee info criterion	-0.647369
Sum squared resid	0.0477B8.	Schwarz criterion	-6.61247t
Log-likelihood	2128834	Hannah-Quinn cñter.	-6.633822
F-statistic	38.0237	Durbin-Watson stat	2.252522
Prob(F-statistic)	0.0000		

Sources: compiled by author by using Eviews.

Table A2
Fixed effect Model (Annex)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002755	0.000361	-7.631187	0.0000
Vaccination_Data_of country	0.000774	0.000424	1.827407	0.0681
Stock_Exchange_Lnreturn	0.671739	0.028704	23.40233	0.0000
Dow_Jonesdaily_Closing index	0.152747	0.044470	3.434840	0.0006
Tradingvolume_of country	0.000371	0.000368	1.007302	0.3141

Cross-section fixed (dummy variables)			
R-squared	0.484701	Mean dependent var	0.002899
Adjusted R-squared	0.474823	S.D.dependent var	0.011838
S.E. of regression	0.008579	Akaike info criterion	-6.658964
Sum squared resid	0.046069	Schwarz criterion	6.568231
Log-likelihood	2140539	Hannan-Quinn criter.	-6.623744
F-statistic	49.06900	Durbin-Watson stat	2.354045
Prob(F-statistic)	0.000000		

Sources: compiled by author by using Eviews.