PANDEMIC IMPACT OF COVID-19 ON THE STOCK MARKET INDEX AND RETURN OF STOCK MARKET INDEX (EVENT STUDY ON STOCK MARKET INDEX IN ASEAN EXCHANGE)

Sutrisno[1]
Bagus Panuntun[2]
Fikri Irfan Adristi[3]
Universitas Islam Indonesia
e-mail: sutrisno@uii.ac.id

ABSTRACT

The purpose of this study is to examine the impact of COVID-19 on six stock market indexes of countries listed on ASEAN Exchanges and three stock market indexes of countries listed on ASEAN Exchanges which have sectoral index of consumer products and property. The variables used in this study were the Coronavirus Disease 2019 (COVID-19) pandemic event; price and return of the six stock market indexes. The sample data in this study were measured based on the entire study period, before the date of the first confirmed case of COVID-19, and after the date of the first confirmed case of COVID-19. The population in this study is all stock market indexes of countries as well as all those that have sectoral index of consumer products and property in ASEAN Exchanges. This study was a population study conducted in the period of 2019-2020 by using the Autoregressive Distributed Lag (ARDL) Model, Autoregressive Conditional Heteroscedasticity (ARCH) Family Models, and California Managed Accounts Reports (Calmar) Ratio as the tools for analysis. The results showed that all the variables tested had a highly significant degenerating long-term relationship due to the impact of the COVID-19 pandemic; there was an ARCH or GARCH effect in all stock market indexes in ASEAN Exchanges affected by the COVID-19 pandemic; and there was a relationship between the COVID-19 pandemic event and the return on the country's stock market index and which for the consumer products and property sector in the ASEAN Exchanges with heterogeneous returns and the distribution of risk levels was inefficient.

Keywords: *COVID-19; stock market index; return stock market index; ARDL Model; ARCH Family Models*

ABSTRAK

Penelitian ini bertujuan untuk melihat dampak COVID-19 terhadap enam indeks saham di negara-negara yang terdaftar pada *ASEAN Exchanges* dan tiga indeks saham dari negara-negara yang terdaftar di *ASEAN Exchanges* yang memiliki indeks sektor konsumer dan properti. Variabel dalam penelitian ini adalah peristiwa pandemi COVID-19, harga dan *return* dari enam indeks saham. Data sampel diukur berdasarkan periode studi secara keseluruhan, sebelum tanggal kasus pertama COVID-19, dan sesudah tanggal kasus pertama COVID-19. Populasi dalam penelitian ini adalah semua indeks saham dari negara-negara

yang terdaftar di *ASEAN Exchanges* dan juga mereka yang memiliki indeks sektor konsumer dan properti. Penelitian ini merupakan penelitian populasi yang dilaksanakan selama periode 2019-2020 dengan menggunakan *Autoregressive Distributed Lag* (ARDL) *Model, Autoregressive Conditional Heteroscedasticity (ARCH) Family Models,* dan *California Managed Accounts Reports* (Calmar) *Ratio*. Hasil penelitian menunjukkan bahwa semua variabel yang diuji memiliki hubungan jangka panjang yang merosot secara signifikan akibat pandemi COVID-19; terdapat efek *ARCH* atau *GARCH* pada semua indeks saham dalam *ASEAN Exchanges* akibat pandemi COVID-19; dan terdapat hubungan antara pandemi COVID-19 dan *return* indeks saham dalam negara-negara tersebut dan juga untuk sektor konsumer dan properti dalam *ASEAN Exchanges* dengan *return* yang heterogen dan distribusi tingkat risiko yang tidak efisien.

Kata kunci: COVID-19; indeks saham; *return* indeks saham; *ARDL Model*; *ARCH Family Models*

1. INTRODUCTION

Coronavirus is one of the main pathogens that substantially targets the human respiratory system. Previous outbreaks of *coronaviruses* (CoVs), including *Severe Acute Respiratory Syndrome* (SARS)-CoV and *Middle East respiratory syndrome* (MERS)-CoV, have previously been marked as agents of threat to community health. WHO then announced a new official name for the disease at February 11, 2020, as COVID-19 (previously known as "2019 *novel coronavirus*") which was caused by the *severe acute respiratory syndrome of coronavirus* 2 (SARS-CoV-2)[1]. As of June 25, 2020, there have been 9,296,202 confirmed positive cases of COVID-19 and 479,133 deaths caused by COVID-19 worldwide. Meanwhile, in Southeast Asia, there were 663,308 confirmed cases of COVID-19 and 19,156 deaths caused by COVID-19 [2].

The lack of unified action to try to control the spread of the virus has driven global stock markets into collective panic and hysteria, resulting in a *black week* on Monday, March 9, 2020, and Thursday, March 12, 2020 with dramatically dropping global stock markets[3]. With the outbreak of the COVID-19 pandemic, investor sentiment is affecting stock market significantly. This investor sentiment will affect the stock *return*[4]. Such situation causes short-term investor overreaction. In Chen *et al*. [5], the previous epidemic of S.A.R.S. has weakened the long-term relationship between the Chinese stock market and the stock markets of Hong Kong, Taiwan, Singapore and Japan. S.A.R.S. Epidemic created some heterogeneity in investment opportunities and resulted in an inefficient international risk sharing environment. In Ichev and Marinč's research[6], it was found that the 2014-2016 Ebola outbreak was followed by negative returns on financial markets. The Ebola outbreak increased anxiety, bad mood, and fear which led to risk aversion and pessimism among investors.

However, in the research conducted by Macciocchi*et al*. [7], the analysis showed positive average returns for each of the three Latin American and Caribbean *Countries* (LCR) stock market indexes affected by the *shock* due to the ZIKV epidemic in the short-term as observed with the following results: Brazil (0.29%), Argentina (0.25%), and Mexico (0.08%).

Furthermore, in the research conducted by Funck and Gutierrez[8] it was found that, in aggregate, negative daily news about Ebola had no impact on securities returns and the average daily excess return on non-news days was 0.05%, compared with 0.52% on news days of Ebola. In addition, this research also found the fact that the pharmaceutical and restaurant industries experienced a statistically significant positive return on the day of negative Ebola news.

So far the world has experienced several epidemics and the spread of infectious diseases such as the Avian Flu (H5N1) pandemic, the Swine Flu (H1N1pdm09) pandemic, the Ebola Virus Disease (EVD) epidemic, the Zika Virus (ZIKV) epidemic, the SARS-CoV epidemic, the MERS-CoV epidemic, and the COVID-19 pandemic. The condition of the epidemic and the spread of infectious diseases certainly not only affects public health but also the macro economy and capital markets. Researching the impact of the COVID-19 pandemic on the stock market index and stock market return indexes of countries listed on the ASEAN Exchanges was a challenge for the author since the COVID-19 pandemic has resulted in extraordinary situations that changed the way people live in the future, which also led to a decline in economic trends, so that would also affect the expectations and sentiment of investors in the capital market which in turn would have an impact on the return of an asset. Anxiety over the COVID-19 pandemic can create negative feelings that can affect investment decisions and subsequent asset returns. In this study, an analysis was conducted on the stock market indexes of countries in ASEAN Exchanges which have sectoral index of consumer products and property in accordance with Wright and Blackburn [9] that some people have had to save their money due to less income than before the outbreak. Then, according to Thorpe and Rockey[10] in terms of the impact on the property sector, COVID-19 causes slower movements and *leasing fundamentals* do not swing from day to day, and certainly, this virus has sustainable and material impact on the broader economy as well as on property.

2. THEORITICAL REVIEW AND HYPOTHESIS DEVELOPMENT

Coronavirus Diseases 2019 (COVID-19)

Coronavirus is a single-stranded RNA virus with a diameter of 80-120 nm. Prior to SARS-CoV-2, there were six *coronaviruses* known to cause disease in humans, including SARS-CoV and MERS-CoV. SARS-CoV-2 is a member of the *Coronaviridae* family and the *Nidovirales* order. The family consists of two subfamilies, namely *Coronavirinae* and *Torovirinae*, and members of the *Coronavirinae* subfamilies are further divided into four *genera*: (a) α-coronavirus includes*humancoronavirus*(HCoV) -229E and HCoV-NL63; (b) *β-coronavirus* includes HCoV-OC43, *Severe Acute Respiratory Syndrome human coronavirus* (SARS-HCoV), HCoV-HKU1, and *Middle Eastern respiratory syndrome coronavirus* (MERS-CoV); (c) *γ-coronavirus*includes whale and avian viruses and; (d) *δ-coronavirus* includes viruses isolated from pigs and birds. SARS-CoV-2 belongs to *β-coronavirus*along with two highly pathogenic viruses, SARS-CoV and MERS-CoV. SARS-CoV-2 is a virus enveloped in *positive-sense single-stranded*RNA (+ ssRNA) virus [12]-[13].

Stock Market Index

According to Lo [14], the traditional definition of index is a weighted-market capitalization of a *fixed set of securities* today which is not because of the inherent superiority or implementation of the economy, but of the past success which has led to inertia in considering other alternatives. According to Caplinger[15], the stock market index is a measure of the stock market, or a small part of the market, which helps investors comparing the current price with the previous price to calculate market performance.

Sectoral Index

According to IGI Global [16], sectoral index is an index that shows the performance of stocks grouped according to certain industries. According to MoneyWords.com [17], sectoral index is a stock exchange composite index that reflects the market activity of a particular industry or sector.

Return and Financial Return

According to Hayes [18], *return* is also known as *financial return*, or in the simpler term, is money generated or lost from an investment over a certain period of time. According to Rust *et al.* (1995) in Nieboer and Gruis[19], basically, the definition of *financial return* is very simple. The realized *financial return* during a certain period are the same as the *net proceedings* that have been realized during that period, related to the initial amount of the invested capital.

Stock Market Return

According to ECONOMYWATCH [20], *stock market return* is the *return* that investors generate from the stock market. This *return* can be in the form of profit through *trading* or in the form of dividends distributed by the company to its shareholders from time to time. *Stock market return* can be obtained through dividends declared by the company.

Short- and Long-Term Relationship

In the study conducted by Chen *et al*. [5], the previous S.A.R.S. epidemic has weakened the long-term relationship between the Chinese stock market and the stock markets of Hong Kong, Taiwan, Singapore and Japan. S.A.R.S. epidemic created some heterogeneity in investment opportunities and resulted in an inefficient international risk sharing environment. In Au *et al*.[21], it was found that the S.A.R.S. impact on the Hong Kong tourism industry was said to be more damaging than the 9-11 event or the 1997 Asian Financial crisis in Hong Kong, however, this event would only have a short-term effect temporarily. In the study conducted by Morales and Andreosso-O'Callaghan [3], it was found that there is a short-term effont on major global stock markets which appears to be the trigger and channel for global turmoil in the COVID-19 pandemic. Based on these considerations, this study proposes the following hypothesis:

H_1: There is a short-term or long-term relationship between the country's stock market index and the country's stock market index

Volatility of Stock Market Index Affected by the COVID-19 Pandemic

In the study Chen*et al*.[22]used an event study with the GARCH process to show that there was a sector-specific positive shock in Taiwan during the SARS outbreak period. The

findings of this study indicated that the stocks of the T&W sector (hotel industry) was sensitive to the SARS outbreak and the stock performance was expected to respond to a repeat of any of such disaster (such as "Avian Flu"). However, not all disasters only have a negative impact on the stock market. The return of shares of the Taiwanese biotechnology company had a positive shock in the face of the SARS crisis; In the study by Liu *et al*. [11], COVID-19 increased stock market volatility in all affected countries, the results of the study also showed a greater effect not only on the stock market in Asia but also the inevitable effect on countries outside Asia. In the study conducted by Pendell and Cho[23], it was found that the outbreak of foot-and-mouth disease of animals increased the volatility of daily returns. Volatility changes were greater when the outbreak lasted for a longer period. Both companies that reacted positively and negatively show increased volatility, indicating that the outbreak increased the risk of return regardless of the impact on company value.

H_2: There is an ARCH and/or GARCH effect in the stock market index of countries listed in ASEAN Exchanges that are affected by the COVID-19 pandemic

The Relationship between COVID-19 Pandemic and Return on the Country's Stock Market Index and Country's Stock Market Index.

In the study conducted by Chen *et al*. [24], at the day and the day after the S.A.R.S. outbreak, the hotel stocks in Taiwan showed significant negative average cumulative *abnormal returns*, indicating a significant impact of the SARS outbreak on the performance of hotel stocks. In the study of Macciocchi*et al*. [7], the analysis showed positive average returns for each of the three Latin American and Caribbean *Countries* (LCR) stock market indexes affected by the shock due to the ZIKV epidemic in the short-term period as observed with the following results: Brazil (0.29%), Argentina (0.25%), and Mexico (0.08%). Al-Awadhi *et al*. [25] stated that, specifically, stock returns were significantly negatively related to daily growth in total confirmed cases and daily growth in total deaths caused by COVID-19.

H_3: There is a relationship between the COVID-19 pandemic and the return on the country's stock market index and the country's stock market index

3. RESEARCH METHOD

Population, Sample, and Data

The population in this study is all stock market indexes of countries as well as all those that have sectoral index of *consumer products* and property in ASEAN Exchanges. This study used a population study method, conducted in the period of 2019-2020.

This study used secondary data obtained from the portal 'investing.com'(https://id.investing.com/)[30] and The Wall Street Journal Market Data (https://www.wsj.com/market-data)[31]. The data used were price and return data in the daily time frame of each country's stock market index as well as the country's stock market index in the consumer products and property sector in the ASEAN Exchanges for the period of June 10, 2019 - June 10, 2020.

Research Variables

The variables of this study were Coronavirus disease 2019 (COVID-19); the prices and returns of six stock market indexes of countries listed in the ASEAN Exchanges and three stock market indexes of countries listed in the ASEAN Exchanges which have sectoral index of consumer products and property. As for the measurement of sample data in this study, the time used was based on the followings:

- During the study period, from June 10, 2019 - June 10, 2020 →to analyze short-term and long-term relationships as well as the volatility of the stock market index of the countries listed and stock market index of consumer products and property sector of countries listed in ASEAN Exchanges.
- Before the date of the first confirmed case the COVID-19 by each ASEAN Exchange member country→to analyze the relationship between the COVID-19 pandemic and returns on the country's stock market index as well as the stock market index of consumer products and property sector of countries listed in ASEAN Exchanges.
- After the date of the first confirmed case the COVID-19 by each ASEAN Exchange member country→to analyze the relationship between the COVID-19 pandemic and returns on the country's stock market index as well as the stock market index of consumer products and property sector of countries listed in ASEAN Exchanges.

The followings are the date of the first confirmed case of COVID-19 of each member country of ASEAN Exchanges to determine the T0 (t-zero):

- Indonesia: March 2, 2020 [32]
- Singapore: January 23, 2020 [33]
- Malaysia: January 25, 2020 [34]
- Thailand: January 13, 2020 [35]
- Vietnam: January 23, 2020 [36]
- Philippines: January 30, 2020 [37]

Data Analysis Method

Autoregressive Distributed Lag* (ARDL) *Model

According to Pesar*et al.* (1999) in Memdani and Shenoy[38], Autoregressive Distributed Lag (ARDL) model is a least squares regression that includes the lag of the dependent and independent variables. The dependent and independent variables are also related through their lagged values. The ARDL model in this study followed Pesar*et al.* (2001) in Memdani and Shenoy[38]which can be written in the following form:

$$\mathrm{yt} = \mu + \mathrm{Xpi} = 1\gamma\mathrm{iyt} - \mathrm{i} + \mathrm{Xr\,j} = 0\,\beta\mathrm{jxt} - \mathrm{j} + \varepsilon\mathrm{t}, \varepsilon \sim \mathrm{i.id}\forall\mathrm{tC(L)yt}$$

$$= \mu + \mathrm{B(L)xt} + \varepsilon\mathrm{t},$$

$$\text{Di mana } \mathrm{C(L)} = 1 - \gamma 1\mathrm{L} - \gamma 2\mathrm{L2} - \cdots - \gamma\mathrm{pLp} \text{ dan}$$

$$\mathrm{B(L)} = \beta 0 + \beta 1\mathrm{L} + \beta 2\mathrm{L2} + \cdots + \beta\mathrm{rLr}$$

The ARDL model is used to show whether there is a short or long term relationship between the COVID-19 pandemic and all stock market indexes of countries listed in the ASEAN Exchanges. In this study, the type of ARDL estimation model used was *Usual Cointegrating Relationship*. In addition, for better analysis results, a *study the speed of adjustment equation* will be carried out using the *Error Correction Form* in this ARDL Model.

Autoregressive Conditional Heteroscedasticity* (ARCH) *Family Models

ARCH and GARCH multi-regression models were used to analyze the volatility of all stock market indexes of countries on the ASEAN Exchanges affected by COVID-19. The equation for the conditional mean is as follows:

$$\mathrm{yt} = \mathrm{x0\ t}\theta + t, \mathrm{t} = 1, 2, \ldots, \mathrm{T}.$$

Often xt contains lag yt and dummies for market specific features. The ARCH (1) model also specifies the equation for conditional variance:

$$\sigma 2\mathrm{t} = \mathrm{E}[2\ t \mid \mathrm{It} - 1] = \prime + \alpha 2\ \mathrm{t} - 1$$

In order to ensure that $\sigma 2\mathrm{t} \geq 0$, it requires ‘ ≥ 0, $\alpha \geq 0$. If 2 t-1 of height, the variance of the next *shock, t,* is great. The researcher made a condition in *information set* It 1 – 1 = {t – 1, t – 2, t – 3,…}. *Least Square* is used to perform tests based on probability values. The *residual* is also checked for volatility graphically. If it meets the level, then the next step can be continued with *The Breusch-Godfrey LM Test for Serial Correlation*, ARCH LM *test* and ARCH *test* with the *coefficient covariance Bollerslev-Wooldridge* which is ultimately used to determine the level of the impact of COVID-19 and the price volatility of the stock market indexes of the countries listed in ASEAN Exchanges..

California Managed Accounts Reports* (Calmar) *Ratio

Calmar ratio was developed by Terry W. Young in 1991. Calmar ratio is short for California Managed Account Report [39]. According to Young (1991) in Carles[40], Calmar ratio is RAPM in which the maximum drawdown is the biggest loss that can be incurred by investors by buying assets at the highest value and selling them at the lowest value. As shown by the equation, Calmar ratio measures the *annualized rate of return on investment's absolute drawdown value*:

$$\text{Calmar ratio} = \frac{R_i}{D_{Max}}$$

Where:

R_i= *Index Return*

D_{Max}= Absolute value of the maximum*drawdown* in a period

The *California Managed Accounts Reports* (Calmar) *Ratio* analysis is used to analyze the performance comparison of the return on the stock market indexes of the countries in the ASEAN Exchanges and the stock market indexes of the countries in the ASEAN Exchanges which have sectoral index of consumer products and property before and after the COVID-19 pandemic.

4. RESULTS

Autoregressive Distributed Lag (ARDL)

Table 1
Summary of *Output* EViews 4.1 ARDL *Long Run Formand Bounds Test*

No	Analysis Object	EC Model (ARDL Long Run Form)
1	Capital Market Index of ASEAN	EC = HARGA_IHSG - (0.4333*HARGA_STI + 0.1248*HARGA_FTSE_MALAYSIA_KLCI - 0.6075*HARGA_SETI -0.8603*HARGA_VNI + 0.7405*HARGA_PSEI)
2	Capital Market Index Consumer Products sector (ASEAN Exchanges)	EC = HARGA_IDX_CONSUMER_INDUSTRY - (97.1474*HARGA_KL_CONSUMER_PRODUCTS - 474.7877*HARGA_SET_CONSUMER_PRODUCTS)
3	Capital Market Index Properti sector (ASEAN Exchanges)	EC = HARGA_IDX_PROPERTY - (0.3335*HARGA_KL_PROPERTY + 11.0439*HARGA_SET_PROPERTY_CONSTRUCTION)

Table 2
Summary *Output* EViews 4.2 ARDL *Long Run Formand Bounds Test* & ARDL *Error Correction Regression*

No	Analysis Object	*F-Statistic* (ARDL *LongRun Form*)	*t-statistic* (ARDL Long Run Form)	CointEq (-1)(ARDL *Error Correction Regression*)	*t-statistic* (ARDL *Error Correction Regression*)
1	Capital Market Index of ASEAN	1,940954	-2,950426	-0,123527	-3,466159
2	Capital Market Index Consumer Products sector (ASEAN Exchanges)	0,32584	-0,030061	-0,001164	-0,995939
3	Capital Market Index Properti sector (ASEAN Exchanges)	3,934846	-0,603854	-0,011023	-3,458156

Based on the Summary Table of Eviews Output 4.2, the F-statistic value is 1.940954; 0.32584; 3.934846, proven to be greater than I (1) *critical value bound*.. The analysis result of this series shows that the null hypothesis is rejected and there is no *equilibrating relationship*. In addition, since the null hypothesis has been rejected and the inclusion of constants or trends in *cointegrating relationships* has not been included, the exposition of this series suggests that the *t-Bounds Test critical* values can be used to determine which alternatives emerge. In the summary, the absolute value of the statistics is |-2.950426| = 2,950426;|-0,030061| = 0,030061; and |-0,603854| = and the result is greater than the absolute value I (0) or I (1) *t-bound*.

These results also indicate that the null hypothesis *t-Boundstest* is rejected, and it can be concluded that the cointegration relationship is one of the usual types, or valid, but *degenerates* based on the variables of each object of analysis and its EC Model in the Summary Table of the Eviews Output 4.1. However, as seen in the suitability between the dependent variable and the equilibration equation, it shows that the relationship is valid. The

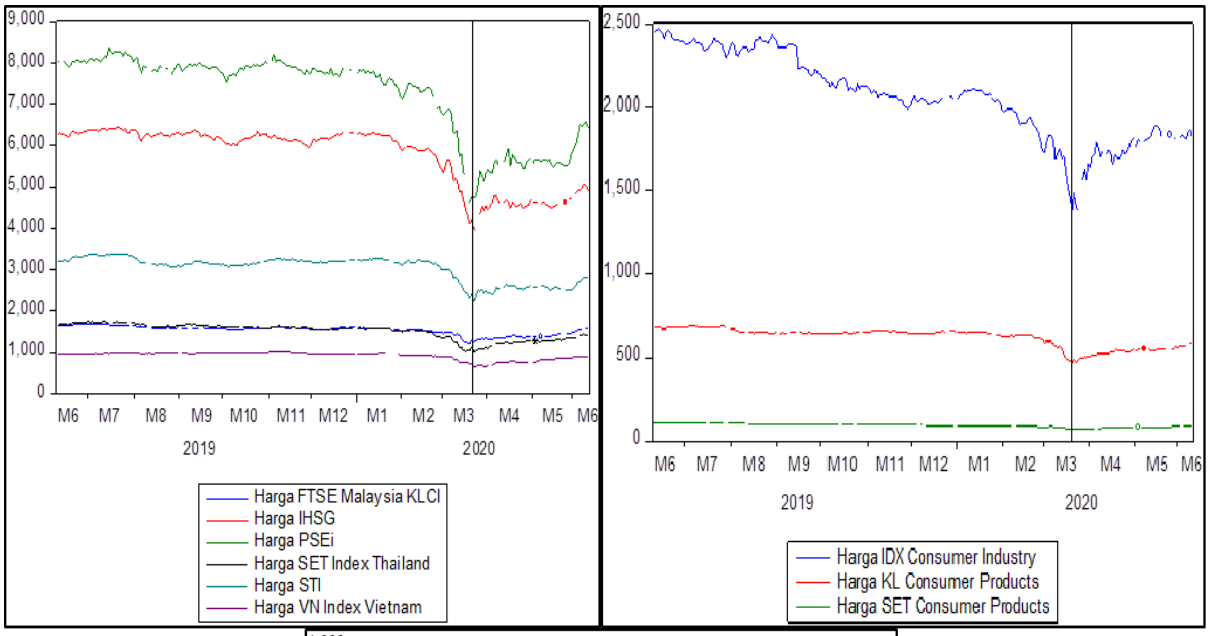
graph regarding the validity of *degeneration* based on the variables of each object of analysis and its EC Model is presented below.

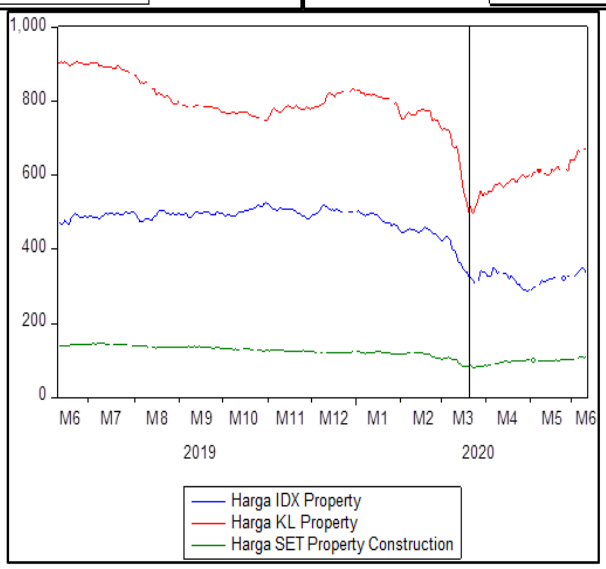
Based on the results of Graph 1, it would certainly be better if there was a *study on the speed of adjustment equation* using the *Error Correction Form*. Error Correction, referred as CointEq (-1) in the Summary Table of EViews Output 4.2, is described as follows:

- Stock Market Indexes of Countries (ASEAN Exchanges): negative with an approximate associated coefficient of -0.123527. This implies that approximately 12.35% of each movement towards disequilibrium is corrected in one period. In addition, with a very large t-statistic of -3.466159, it can be concluded that the coefficient is highly significant.
- Stock Market Sectoral Index of Consumer Products (ASEAN Exchanges): negative with an approximate associated coefficient of -0.001164. This implies that approximately 0.116% of each movement towards disequilibrium is corrected in one period. In addition, with a large t-statistic of -0.995939, it can be concluded that the coefficient is highly significant.
- Stock Market Sectoral Index of Property (ASEAN Exchanges): negative with an approximate associated coefficient of -0.011023. This implies that approximately 1.10% of each movement towards disequilibrium is corrected in one period. In addition, with a very large t-statistic of -3.458156, it can be concluded that the coefficient is highly significant.

Graph 1

Degenerate Relationship of Six Country Stock Market Indices and Three Country Stock Market Indices for Consumer Products and Property Sector in ASEAN Exchanges





ARCH (*Autoregressive Conditional Heteroskedasticity*)

Table 3

Summary of *Output* EViews 4.3 *Mean Model*, *Variance Model*, and *Probability* RESID(-1)^2 for ARCH *Bollerslev-Wooldridge*

No	Analysis Object	*Probability* RESID(-1)^ for ARCH *Bollerslev-Wooldridge*
1	Price of IDX Composite (IHSG)	0,0000
2	Straits Times Index (STI)	0,0000
3	FTSE Malaysia index (KLCI)	0,0000
4	SET Price Index Thailand	0,0000
5	VN Price Index Vietnam	0,0000
6	PSEi Composite Price Index Filipina	0,0000

Based on the Summary Table of EViews Output 4.3, the *probability* in RESID (-1)^2 on the ARCH Bollerslev-Wooldridge on the Prices of IDX Composite (JCI); Straits Times Index (STI); FTSE Malaysia KLCI; Thailand SET Index; VN Index Vietnam; and the Philippines PSEi Composite, shows that the result is 0.0000 (<1%).

GARCH (*Generalized Autoregressive Conditional Heteroskedasticity*)

Based on *Output*EViews 4.5, the interpretation for each index is as follow:

- Price of IDX Composite (IHSG)

The order used was ARCH, GARCH (1,1), and the results of the components wereRESID(-1)^2 (Prob. 0,0000) (<1%)which were significant and GARCH(-1)(Prob. 0,7574) (>1%) which was not significant with each*meanmodel*and *variancemodel*as follow:

$$\text{Composite Share Price Index} = 6272{,}186 + e_t$$

$$\sigma^2_t = 1017{,}058 + 0{,}988783\ e^2_{t-1} + 0{,}028863\sigma^2_{t-1}$$

- Price of Straits Times Index (STI)

The order used was ARCH, GARCH (2,1) and the results of the components were the RESID(-1)^2 (Prob. 0,0000) (<1%), RESID(-2)^2 (Prob. 0,0000) (<1%), and GARCH(-1) (Prob. 0,0000) (<1%) which were significant with each*meanmodel*and*variancemodel*as follow:

$$\text{Harga STI} = 3210{,}169 + e_t$$

$$\sigma^2_t = 50{,}64068 + 1{,}093615\ e^2_{t-1} - 0{,}788141\ \sigma^2_{t-1} + 0{,}723171\ \sigma^2_{t-2}$$

- Price of FTSE Malaysia KLCI

The order used was ARCH, GARCH (1,1), and the results of the components were RESID(-2)^2 (Prob. 0,0000) (<1%) and GARCH(-1) (Prob. 0,0088) (<1%), which were significant witheach *meanmodel* and *variancemodel* as follow:

$$\text{Proice of FTSE Malaysia KLCI} = 1598{,}932 + e_t$$

$$\sigma^2_t = 16{,}82270 + 0{,}817464\ e^2_{t-1} + 0{,}205592\ \sigma^2_{t-1}$$

- Price of Thailand SET Index

The order used was ARCH, GARCH (1,1), and the results of the components were RESID(-2)^2 (Prob. 0,0000) (<1%) and GARCH(-1) (Prob. 0,0000) (<1%) which were significant with each *meanmodel*and*variancemodel* as follow:

$$\text{Price of SET Index Thailand} = 1619{,}397 + e_t$$

$$\sigma^2_t = 149{,}6036 + 1{,}209497\ e^2_{t-1} - 0{,}152897\ \sigma^2_{t-1}$$

- Price of Vietnam VN Index

The order used was ARCH, GARCH (1,1) and the results of the components were RESID(-2)^2 (Prob. 0,0000) (<1%) which were significant and GARCH(-1) (Prob. 0,9124) (>1%) which was not significant with each*mean model*and*variance model*as follow:

$$\text{Price of VN Index Vietnam} = 976{,}3642 + e_t$$
$$\sigma^2_t = 28{,}05114 + 1{,}034817\ e^2_{t-1} - 0{,}009880\ \sigma^2_{t-1}$$

- Price of PhilippinePSEi Composite

The order used was ARCH, GARCH (1,2) and the results of the components were RESID(-2)^2 (Prob. 0,0000) (<1%) and GARCH(-2) (Prob. 0,0000) (<1%) which were significant and GARCH(-1) (Prob. 0,0314) (<1%) which was not significant with each*mean model*and*variance model*as follow:

$$\text{Price of PSEi Composite Filipina} = 7854{,}585 + e_t$$
$$\sigma^2_t = 3233{,}031 + 1{,}034286\ e^2_{t-1} + 0{,}099166\ \sigma^2_{t-1} - 0{,}104805\ \sigma^2_{t-2}$$

***California Managed Accounts Reports* (Calmar) Ratio**

Tabel 4
***Output* Calmar Model for Comparison of Stock Market Return on ASEAN Exchange**

Annual Performance return based on the Calmar Ratio Approach on the Impact of Covid-19 Pendemic on the Stock Market Indexes of Listed on ASEAN Exchange		
Stock Market Index	Before	After
Price of IDX Composit Inex (IHSG)	-0,7496	-0,0915
Straits Times Index (STI)	0,1292	-0,1525
FTSE Bursa Malaysia KLCI Index (FBM KLCI)	-0,2028	-0,0754
The Stock Exchange of Thailand Index (SETI)	-0,2194	-0,1203
Vietnam Ho Chi Minh Stock Index (VNI)	0,1799	-0,0683
Philippine Stock Exchange Index (PSEi)	-0,3483	-0,1171

The interpretations of the output of Calmar model (Table 4.4) are as follows:

- The return performance of the Straits Times Index (STI) and Vietnam Ho Chi Minh Stock Index (VNI) before the COVID-19 pandemic was better than the period after the COVID-19 pandemic. This was due to a decrease in the value of the Calmar ratio of each of the country's stock market index.
- The return performance of the Prices of IDX Composite (IHSG), FTSE Bursa Malaysia KLCI Index (FBM KLCI), The Stock Exchange of Thailand Index (SETI), Philippine Stock Exchange Index (PSEi) after the COVID-19 pandemic were better than the period before the COVID-19 pandemic event. This was due to the increase in the value of the Calmar ratio of each of the country's stock market index. However, if measured from the perspective of trading performance, none of the country's stock market index had generated profit because all of these indexes had negative Calmar ratio values.
- The best return performance from all stock market indexes of countries listed on the ASEAN Exchangers was found in the IDX Composite (IHSG), which had the highest difference in the value of Calmar ratio after the COVID-19 pandemic, which was 0.6580.

Meanwhile, the worst return performance of all stock market indexes of countries registered at ASEAN Exchanges was found in the Straits Times Index (STI) which had the lowest difference in the value of the Calmar ratio after the COVID-19 pandemic, which was -0.2817.

Tabel 4
***Output* Calmar Model for Comparison of Stock Market Return for Consumer Products and Property on ASEAN Exchange**

Annual Performance return based on the Calmar Ratio Approach on the Impact of Covid-19 Pendemic on the Stock Market Indexes of Listed on ASEAN Exchange		
Indeks Pasar Saham Negara	Before	After
IDX Consumer Goods Industry Sector Index	-1,6962	0,0715
IDX Property, Real Estate, and Building Construction Sector Index	-0,5020	-0,2856
KL Consumer Products & Services	-0,1893	-0,5704
KL Property	-0,4418	-0,6312
SET Consumer Products	-0,7477	-0,1517
SET Property & Construction	-0,5639	-0,1098

The interpretations of the output of Calmar model (Table 4.4) are as follows:

- The return performance of KL Consumer Products & Services and KL Property before the COVID-19 pandemic was better than the period after the COVID-19 pandemic. This was due to a decrease in the value of the Calmar ratio of each of the country's stock market index.
- The return performance of the IDX Consumer Goods Industry Sector Index, IDX Property, Real Estate, and Building Construction Sector Index, SET Consumer Products, and SET Property & Construction after the COVID-19 pandemic was better than the period before the COVID-19 pandemic. This was due to the increase in the value of the Calmar ratio of each of the country's stock market index. However, if measured from the perspective of trading performance, only the IDX Consumer Goods Industry Sector Index that was profitable because it had a positive Calmar ratio value of 0.0715.
- The best return performance of all stock market indexes of countries in the consumer products and property sector listed in the ASEAN Exchanges was found in the IDX Consumer Goods Industry Sector Index, which had the highest difference in the value of the Calmar ratio after the COVID-19 pandemic, which was 1.7677.
- Meanwhile, the worst return performance of all stock market indexes of countries in the consumer products and property sector listed in the ASEAN Exchanges was foudn in KL Consumer Products & Services, which had the lowest difference in the value of the Calmar ratio after the COVID-19 pandemic, which was -0.3810.

Table 5

***Output* EViews 4.5 Ordo ARCH, GARCH *Bollerslev-Wooldridge* Stock Market Index on ASEAN Exchanges**

Dependent Variable: HARGA_IHSG
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 09/25/20 Time: 22:15
Sample: 6/10/2019 6/10/2020
Included observations: 250
Convergence achieved after 35 iterations
Coefficient covariance computed using Bollerslev-Wooldridge QML sandwich with expected Hessian
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	6272.186	2.618814	2395.048	0.0000
Variance Equation				
C	1017.058	327.9584	3.101179	0.0019
RESID(-1)^2	0.988783	0.100324	9.855936	0.0000
GARCH(-1)	0.028863	0.093429	0.308929	0.7574

Dependent Variable: HARGA_STI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 09/20/20 Time: 01:26
Sample: 6/10/2019 6/10/2020
Included observations: 253
Convergence achieved after 61 iterations
Coefficient covariance computed using Bollerslev-Wooldridge QML sandwich with expected Hessian
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*RESID(-2)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	3210.169	1.214591	2643.004	0.0000
Variance Equation				
C	50.64068	35.59030	1.422879	0.1548
RESID(-1)^2	1.093615	0.060018	18.22131	0.0000
RESID(-2)^2	-0.788141	0.173608	-4.539784	0.0000
GARCH(-1)	0.723171	0.163936	4.411310	0.0000

Dependent Variable: HARGA_FTSE_MALAYSIA_KLCI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 09/25/20 Time: 22:39
Sample: 6/10/2019 6/10/2020
Included observations: 248
Convergence achieved after 34 iterations
Coefficient covariance computed using Bollerslev-Wooldridge QML sandwich with expected Hessian
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1598.932	0.480524	3327.478	0.0000
Variance Equation				
C	16.82270	4.789282	3.512572	0.0004
RESID(-1)^2	0.817464	0.092193	8.866844	0.0000
GARCH(-1)	0.205592	0.078463	2.620235	0.0088

Dependent Variable: HARGA_SETI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 09/26/20 Time: 03:21
Sample: 6/10/2019 6/10/2020
Included observations: 248
Failure to improve likelihood (non-zero gradients) after 66 iterations
Coefficient covariance computed using Bollerslev-Wooldridge QML sandwich with expected Hessian
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1619.397	0.052699	30729.24	0.0000
Variance Equation				
C	149.6036	31.13260	4.805367	0.0000
RESID(-1)^2	1.209497	0.055760	21.69114	0.0000
GARCH(-1)	-0.152897	0.035077	-4.358896	0.0000

Dependent Variable: HARGA_VNI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 09/27/20 Time: 21:50
Sample: 6/10/2019 6/10/2020
Included observations: 253
Convergence achieved after 34 iterations
Coefficient covariance computed using Bollerslev-Wooldridge QML sandwich with expected Hessian
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	976.3642	0.394872	2472.612	0.0000
Variance Equation				
C	28.05114	8.384462	3.345610	0.0008
RESID(-1)^2	1.034817	0.104546	9.898180	0.0000
GARCH(-1)	-0.009880	0.089800	-0.110024	0.9124

Dependent Variable: HARGA_PSEI
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 09/28/20 Time: 00:41
Sample: 6/10/2019 6/10/2020
Included observations: 248
Convergence achieved after 46 iterations
Coefficient covariance computed using Bollerslev-Wooldridge QML sandwich with expected Hessian
Presample variance: backcast (parameter = 0.7)
GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1) + C(5)*GARCH(-2)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	7854.585	3.394735	2313.755	0.0000
Variance Equation				
C	3233.031	735.7755	4.394046	0.0000
RESID(-1)^2	1.034286	0.053765	19.23716	0.0000
GARCH(-1)	0.099166	0.046072	2.152429	0.0314
GARCH(-2)	-0.104805	0.022303	-4.699210	0.0000

5. DISCUSSION

The Relationship between Short-Term and Long-Term Relationships of Stock Market Indexes of the Countries and Stock Market Indexes of the Countries

Thus, based on the description and explanation on the Results of the Research, the **alternative hypothesis (H_1) is accepted,** as follow:

- The price of IDX Composite has a long-term relationship with the prices of STI, FTSE Bursa Malaysia KLCI, Thailand SET Index, Vietnam VN Index Price, and PSEi Composite which ***degenerate highly significant*** due to the impact of the COVID-19

pandemic. This was due to the COVID-19 pandemic has resulted in an extraordinary situation which could result in a downturn in economic trends, so that it would also affect investors' expectation and sentiment in the capital market which ultimately would have an impact on the return of an asset, especially for the stock market indexes of countries listed in ASEAN Exchanges.

- The IDX Consumer Industry price has a long-term relationship with the prices of KL Consumer Products and the SET Consumer Products which ***degenerate highly significant*** due to the impact of the COVID-19 pandemic. According to Wright and Blackburn [9], this was due to the consumers were highly worried about the impact of this pandemic on society at large and some consumers had had to save their spending due to less income than before the outbreak.
- The price of IDX Property has a long-term relationship with KL Property and SET Consumer Property & Construction which ***degenerate highly significant*** due to the impact of the COVID-19 pandemic. According to Thorpe and Rockey[10] in terms of the impact on the sector property, this was due to the COVID-19 caused slower movement and leasing fundamentals were not busy day by day. Certainly, this virus has a sustainable and material impact on the broader economy, as it will have an impact on property.

Then, the overall results of the above discussion were also supported by the results of previous studies, namely: (1) the study conducted by Chaouachi&Chaouachi[41], in which the results showed that there was only a negative impact of COVID-19 on the KSA Stock Exchange (TASI) in the long-term relationship. The causality test showed unidirectional causality from the prevalence measure of COVID-19 to the stock market as well; (2) the study conducted by Gherghina, Armeanu, &Joldes[42] where the empirical findings from the ARDL model and the Granger causality test confirmed the existence of long-term and short-term relationships between the Romanian capital market and the COVID-19 variable.

Volatility of Stock Market Indexes of Countries Listed in ASEAN Exchanges Affected by COVID-19 Pandemic

Research, it can be seen that the ***alternative hypothesis*** **(H_2)** is accepted that there is an ARCH or GARCH effect in all stock market indexes of countries listed in ASEAN Exchanges affected by the COVID-19 pandemic as this can occur because the phenomenon of the COVID-19 accidental death case provides an informative 'opportunity' for market players to learn something about investor psychology and human behavior. The Covid-19 pandemic represents a new and frightening risk. Thus, this triggers the feverish behavior of investors. Thus we can clearly realize that financial markets are human driven, and, as such, very behaving, regardless of fundamental trends [43].

Then these results are also reinforced from the results of previous studies, namely (1) the study conducted by Liu *et al*. [11] on COVID-19, it was found that the stock market volatility in all affected countries increased. The results of study also show a greater impact not only on the stock market in Asia but also the inevitable effect on countries outside Asia; and; (2) the study conducted by Apergis&Apergis research [43] using the GARCHX model allows us to explore the Covid-19 information into the GARCH framework of which results

show that the daily increase in the total number of confirmed cases of Covid-19 in China, measured as total daily deaths and cases, has a significant negative impact on stock returns with the negative impact of Covid-19's on stock returns becoming more pronounced when the total deaths represent the impacts of such infectious disease.

Impact on the Return on the Stock Market Indexes of Countries and the Stock Market Indexes of Countries Listed in the ASEAN Exchanges for Consumer Products and Property Sector

From the overall output and analysis on the Calmar model contained in the Research Results, we can see that the ***alternative hypothesis (H_3) is accepted***, that there is a relationship between the COVID-19 pandemic and return on the stock market indexes of countries and the stock market indexes of countries listed in ASEAN Exchanges in the consumer products and property sector. This was due to the outbreak/pandemic of a disease which can result in panic and different perceptions for investors in the capital market regarding an asset, causing the index price movement to become *volatile*. So that, when it was analyzed using the Calmar model, the rate of return becomes heterogeneous and varied and the division of the level of risk becomes inefficient.

Furthermore, these results were also supported by the results of previous studies, as follows: (1) In the study conducted by IchevdanMarinč[6], it was found that the results of the 2014-2016 Ebola outbreak were followed by negative returns on financial markets and they also confirmed that geographic proximity of information to financial markets increased the importance of events (related to the 2014-2016 Ebola outbreak) and their impact on company stock returns, (2) In the study conducted by Chen *et al*. [24] at the time and after the S.A.R.S. outbreak day, hotel stocks in Taiwan showed significant negative average cumulative *abnormal returns*, indicating the significant impact of the SARS outbreak on the performance of hotel stocks as well, (3) In the study conducted by Macciocchi*et al*. [7], the analysid shows a positive average return for each of the three Latin American and Caribbean *Countries* (LCR) stock market indexes affected by shock due to the ZIKV epidemic in the short-term period as observed with the following results: Brazil (0.29%), Argentina (0.25%), and Mexico (0.08%).

6. CONCLUSIONS AND RECOMMENDATIONS

Based on data analysis and the discussion regarding the impact of the COVID-19 pandemic on the stock market index and stock market return index, especially on the stock market indexes of countries and the state stock market indexes of countries listed in ASEAN Exchanges for the consumer products and property sectors, it can be concluded as follows:

The price of IDX Composite has a long-term relationship with the prices of STI, FTSE Bursa Malaysia KLCI, Thailand SET Index, Vietnam VN Index Price, and PSEi Composite which ***degenerate highly significant*** due to the impact of the COVID-19 pandemic. The IDX Consumer Industry price has a long-term relationship with the prices of KL Consumer Products and the SET Consumer Products which ***degenerate highly significant*** due to the impact of the COVID-19 pandemic. The price of IDX Property has a long-term relationship with KL Property and SET Consumer Property & Construction which ***degenerate highly significant*** due to the impact of the COVID-19 pandemic. There was an ARCH or GARCH

effect in all stock market indexes of countries listed in ASEAN Exchanges affected by the COVID-19 pandemic. There was a relationship between the COVID-19 pandemic and the return on the stock market indexes of countries and the stock market indexes of countries for the consumer products and property sector in the ASEAN Exchanges with returns that were heterogeneous/varied and the distribution of risk levels became inefficient.

REFERENCES

[1] World Health Organization, "Naming the coronavirus disease (COVID-19) and the virus that causes it," 2020. https://www.who.int/fr/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it (accessed Jun. 03, 2020).

[2] World Health Organization, "Coronavirus disease (COVID-19) Situation Report – 157," 2020. [Online]. Available: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200625-covid-19-sitrep-157.pdf?sfvrsn=423f4a82_2.

[3] L. Morales and B. Andreosso-O´Callaghan, "Covid-19: Global Stock Markets 'Black Swan,'" *Crit. Lett. Econ. Financ.*, vol. 1, no. 1, pp. 1–14, 2020, [Online]. Available: https://arrow.tudublin.ie/clef/vol1/iss1/1/.

[4] S. V. Anusakumar, R. Ali, and H. C. Wooi, "The Effect of Investor Sentiment on Stock Returns: Insight from Emerging Asian Markets," *Asian Acad. Manag. J. Account. Financ.*, vol. 13, no. 1, pp. 159–178, 2017, doi: 10.21315/aamjaf2017.13.1.7.

[5] M. P. Chen, C.-C. Lee, Y.-H. Lin, and W.-Y. Chen, "Did the S.A.R.S. epidemic weaken the integration of Asian stock markets? Evidence from smooth time-varying cointegration analysis," *Econ. Res. Istraz.*, vol. 31, no. 1, pp. 908–926, 2018, doi: 10.1080/1331677X.2018.1456354.

[6] R. Ichev and M. Marinč, "Stock prices and geographic proximity of information: Evidence from the Ebola outbreak," *Int. Rev. Financ. Anal.*, vol. 56, no. August 2017, pp. 153–166, 2018, doi: 10.1016/j.irfa.2017.12.004.

[7] D. Macciocchi *et al.*, "Short-term economic impact of the Zika virus outbreak," *New Microbiol.*, vol. 39, no. 4, pp. 287–289, 2016, [Online]. Available: https://pubmed.ncbi.nlm.nih.gov/28004846/.

[8] M. Funck and J. A. Gutierrez, "Has Ebola infected the market: A contagious reaction to a (media) health care crisis?," *J. Bus. Strateg.*, pp. 1–20, 2018, doi: 10.2139/ssrn.2786001.

[9] O. Wright and E. Blackburn, "COVID-19 is Reshaping the Consumer Goods Industry," 2020. [Online]. Available: https://www.accenture.com/_acnmedia/PDF-127/Accenture-COVID-19-CGS-Pulse-Survey-Research-Wave-4.pdf.

[10] K. J. Thorpe and R. Rockey, "CORONAVIRUS: IMPACT ON THE GLOBAL

PROPERTY MARKETS PART ONE," 2020. [Online]. Available: https://www.cushmanwakefield.com/en/united-states/insights/2020-coronavirus-and-impact-on-the-property-markets.

[11] H. Liu, A. Manzoor, C. Wang, L. Zhang, and Z. Manzoor, "The COVID-19 Outbreak and Affected Countries Stock Markets Response," *Int. J. Environ. Res. Public Health*, vol. 17, no. 8, pp. 1–19, 2020, doi: 10.3390/ijerph17082800.

[12] L. Wang, Y. Wang, D. Ye, and Q. Liu, "Review of the 2019 novel coronavirus (SARS-CoV-2) based on current evidence," *Int. J. Antimicrob. Agents*, vol. xxx, no. xxxx, pp. 1–7, 2020, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S0924857920300984?via%3Dihub.

[13] H. Harapan *et al.*, "Coronavirus disease 2019 (COVID-19): A literature review," *J. Infect. Public Health*, vol. 13, no. 5, pp. 667–673, 2020, [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1876034120304329.

[14] A. W. Lo, "What is an index?," *J. Portf. Manag.*, vol. 42, no. 2, pp. 21–36, 2016, doi: 10.3905/jpm.2016.42.2.021.

[15] D. Caplinger, "What Is a Stock Market Index?," 2020. https://www.fool.com/knowledge-center/what-is-a-stock-index.aspx (accessed Jun. 07, 2020).

[16] IGI Global, "What is Sector Indices." https://www.igi-global.com/dictionary/sector-indices/68252 (accessed Jul. 08, 2020).

[17] MoneyWords.com, "Sector Index." https://www.moneywords.com/sector-index (accessed Jul. 08, 2020).

[18] A. Hayes, "A Return in Finance," 2020. https://www.investopedia.com/terms/r/return.asp (accessed Jun. 07, 2020).

[19] V. Gruis and N. Nieboer, "Financial and social returns in housing asset management: Theory and Dutch housing associations' practice," *Urban Stud.*, vol. 42, no. 10, pp. 1771–1794, 2005, doi: 10.1080/00420980500231696.

[20] ECONOMYWATCH, "Stock Market Returns," 2010. https://www.economywatch.com/stock-markets-in-world/returns.html (accessed Jun. 07, 2020).

[21] A. K. M. Au, B. Ramasamy, and M. C. H. Yeung, "The Effects of SARS on the Hong Kong Tourism Industry: An Empirical Evaluation," *Asia Pacific J. Tour. Res.*, vol. 10, no. 1, pp. 85–95, 2005, doi: 10.1080/1094166042000330236.

[22] C.-D. Chen, C.-C. Chen, W.-W. Tang, and B.-Y. Huang, "The Positive and Negative Impacts of the Sars Outbreak: A Case of the Taiwan Industries," *J. Dev. Areas*, vol. 43, no. 1, pp. 281–293, 2009, doi: 10.1353/jda.0.0041.

[23] D. L. Pendell and C. Cho, "Stock Market Reactions to Contagious Animal Disease

Outbreaks: An Event Study in Korean Foot-and-Mouth Disease Outbreaks," *Agribus. An Int. J.*, vol. 29, no. 4, pp. 1–14, 2013, doi: 10.1002/agr.21346.

[24] M. Chen, S. (Shawn) Jang, and W. G. Kim, "The impact of the SARS outbreak on Taiwanese hotel stock performance: An event-study approach," *Int. J. Hosp. Manag.*, vol. 26, no. 1, pp. 200–212, 2007, doi: 10.1016/j.ijhm.2005.11.004.

[25] A. M. Al-Awadhi, K. Alsaifi, A. Al-Awadhi, and S. Alhammadi, "Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns," *J. Behav. Exp. Financ.*, vol. 27, p. 100326, 2020, doi: 10.1016/j.jbef.2020.100326.

[26] ASEAN Exchanges, "ASEAN Exchanges," 2019. http://www.aseanexchanges.org/#/ (accessed Jun. 06, 2020).

[27] Indonesia Stock Exchange, "Index." https://www.idx.co.id/en-us/products/index/ (accessed Jul. 08, 2020).

[28] Bursa Malaysia, "BURSA MALAYSIA SECTOR CLASSIFICATION OF APPLICANTS OR LISTED ISSUERS," Kuala Lumpur, 2018. [Online]. Available: https://www.bursamalaysia.com/sites/5bb54be15f36ca0af339077a/content_entry5ce3b50239fba2627b2864be/5ce3ba8e5b711a16ea84c68f/files/listing_requirement_ace_market_classification_applicants_Sep2018.pdf?1570701427.

[29] The Stock Exchange of Thailand, "SET Industry Group and Sector Classification Structure," Bangkok, 2015. [Online]. Available: https://www.set.or.th/en/products/index/setindex_p2.html.

[30] Fusion Media Limited, "investing.com." https://id.investing.com/ (accessed Jun. 26, 2020).

[31] I. Dow Jones & Company, "The Wall Street Journal Market Data," 2020. https://www.wsj.com/market-data (accessed Jun. 19, 2020).

[32] R. Ratcliffe, "First coronavirus cases confirmed in Indonesia amid fears nation is ill-prepared for outbreak," 2020. https://www.theguardian.com/world/2020/mar/02/first-coronavirus-cases-confirmed-in-indonesia-amid-fears-nation-is-ill-prepared-for-outbreak (accessed Jun. 26, 2020).

[33] Government of Singapore, "CONFIRMED IMPORTED CASE OF NOVEL CORONAVIRUS INFECTION IN SINGAPORE; MULTI-MINISTRY TASKFORCE RAMPS UP PRECAUTIONARY MEASURES," 2020. https://www.moh.gov.sg/news-highlights/details/confirmed-imported-case-of-novel-coronavirus-infection-in-singapore-multi-ministry-taskforce-ramps-up-precautionary-measures (accessed Jun. 26, 2020).

[34] Reuters, "Malaysia confirms first cases of coronavirus infection," 2020. https://www.reuters.com/article/china-health-malaysia/malaysia-confirms-first-cases-of-coronavirus-infection-idUSL4N29U03A (accessed Jun. 26, 2020).

[35] E. Cheung, "Wuhan pneumonia: Thailand confirms first case of virus outside China," 2020. https://www.scmp.com/news/hong-kong/health-environment/article/3045902/wuhan-pneumonia-thailand-confirms-first-case (accessed Jun. 26, 2020).

[36] J. Coleman, "Vietnam reports first coronavirus cases," 2020. https://thehill.com/policy/healthcare/public-global-health/479542-vietnam-reports-first-coronavirus-cases (accessed Jun. 26, 2020).

[37] A. France-Presse, "Coronavirus: What we know about first death outside China," 2020. https://www.rappler.com/nation/250815-coronavirus-what-we-know-about-first-death-outside-china (accessed Jun. 26, 2020).

[38] L. Memdani and G. Shenoy, "Impact of terrorism on stock markets across the world and stock returns: An event study of Taj attack in India," *J. Financ. Crime*, vol. 26, no. 3, pp. 793–807, 2019, doi: 10.1108/JFC-09-2018-0093.

[39] W. Kenton, "Calmar Ratio," 2018. https://www.investopedia.com/terms/c/calmarratio.asp (accessed Jun. 27, 2020).

[40] H. K. Baker and G. Filbeck, Eds., *Investment Risk Management*. New York, NY: Oxford University Press, 2015.

[41] M. Chaouachi and C. Slim, "Current COVID-19 Impact on Saudi Stock Market: Evidence from An ARDL Model," *Int. J. Accounting, Financ. Audit. Manag. Econ.*, vol. 1, no. 1, pp. 1–13, 2020, doi: 10.5281/zenodo.3930788.

[42] Ștefan C. Gherghina, D. Ștefan Armeanu, and C. C. Joldeș, "Stock market reactions to COVID-19 pandemic outbreak: Quantitative evidence from ARDL bounds tests and granger causality analysis," *Int. J. Environ. Res. Public Health*, vol. 17, no. 18, pp. 1–35, 2020, doi: 10.3390/ijerph17186729.

[43] N. Apergis and E. Apergis, "The role of Covid-19 for Chinese stock returns: evidence from a GARCHX model," *Asia-Pacific J. Account. Econ.*, vol. 00, no. 00, pp. 1–9, 2020, doi: 10.1080/16081625.2020.1816185.