



Short-Term Impact of COVID-19 Pandemic In Indonesian Stock Prices

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Abstract

The Indonesian stock market is unique because of its economic relations with China and the United States, the world's two biggest economies that are severely impacted by the COVID-19 pandemic. This study examines the short-term impact of the COVID-19 pandemic on stock price movements on the Indonesian stock exchange. Our investigation identifies patterns of market responses in terms of stock price movements in the period. We find that the outbreak has affected, in terms of market response, the manufacturing and non-manufacturing stocks similarly. The impact of the outbreak seems to be felt by almost all economic sectors in a similar way. However, based on the result, the investors' perception of the finance sector is more favorable relative to the other sectors during the pandemic. Several stocks identified have the potential to re-bounce if market conditions return to normal.

Dampak Jangka Pendek Pandemi COVID-19 Terhadap Harga Saham Indonesia

Abstrak

Pasar saham Indonesia unik karena hubungannya dengan China dan Amerika Serikat, dua ekonomi terbesar dunia yang terkena dampak parah dari pandemi COVID-19. Penelitian ini mengkaji lebih dalam dampak jangka pendek pandemi COVID-19 terhadap pergerakan harga saham pada bursa efek Indonesia. Investigasi kami mengidentifikasi pola respons pasar dalam hal pergerakan harga saham pada periode tersebut. Kami menemukan bahwa pandemi COVID-19 telah berdampak pada respons pasar, pada harga saham manufaktur dan non-manufaktur dengan cara yang sama. Dampak wabah tersebut tampaknya dirasakan oleh hampir semua sektor ekonomi dengan cara yang sama. Namun, berdasarkan hasil tersebut, persepsi investor di sektor keuangan lebih baik dibandingkan sektor lain selama pandemi. Beberapa saham teridentifikasi berpotensi rebound jika kondisi pasar kembali normal.

JEL Classification: M20, M21, M29

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INTRODUCTION

In early 2020, the world was shocked by the spread of a disease caused by a new SARS-CoV-2 corona virus, called Corona Virus Disease 2019 (Covid-19). Covid-19 first cases were identified at the end of December 2019 in Wuhan, China. On March 2nd, 2020, Indonesian President Joko Widodo reported the first two confirmed cases of Covid-19 infection in Indonesia. As of April 23rd, 2020, Covid-19 has affected 211 countries, with 2,649,680 people confirmed positive for Covid-19 and 184,643 confirmed death. At the same time, Indonesia had reached 7,775 confirmed cases of Covid-19, with 647 deaths and 960 total recoveries (WHO, 2020). Being the fourth most populous country, it is predicted that Indonesia will experience the impact of Covid-19 for a more extended period when compared to other less densely populated countries (Djalante et al., 2020).

China, as the first country affected by the pandemic, received great attention from the world because of its significant role in the world economy. United States as the world's biggest economy, on April 23, 2020, recorded the highest number of patients infected with Covid-19 in the world. In the last decade, China has become the number one trade partner for Indonesia and ASEAN countries, and the decline in economic growth in China will have a negative impact on Indonesia and ASEAN countries. On the other hand, the US has a significant role in the Indonesian economy as one of the leading export destination countries. Indonesia is identified as the 25th largest exporter to the US, and Indonesia ranks 15th out of 16 countries identified as having a trade deficit in goods with the US (Pangestu, 2019). The decrease on economic growth experienced by China and the US will affect the Indonesian economy, given that these two countries are important trading partners for Indonesia.

Zhang et al. (2020) analyzed the impact of the Covid-19 pandemic on the increased risk for the investor on world stock markets and suggest that there was a dramatic movement in financial markets on an unprecedented scale. These results

indicate that the risks of global financial markets have increased substantially in response to a pandemic. Individual stock market reactions were found to be related to the severity of outbreaks in each country. Uncertainty from the pandemic and economic losses has caused the market to be very volatile and unpredictable. Indonesia, as part of the global financial system, will undoubtedly be affected both on a macro and micro scale, and the Covid-19 pandemic will cause uncertainty in the stock market in Indonesia.

Every investor tries to minimize risk and increase returns. To be able to do that, they need to form the right portfolio for their investment (Markowitz, 1952, 1991; Fama, 2012; Foye & Valentinčič, 2020). The Covid-19 pandemic certainly increases uncertainty in the global economy including Indonesia's, which in turn will increase risk and decrease the return possibility in investment. The stock market in emerging markets has an important role in the economy because it is a source of capital flow from foreign investors (Collins et al., 2014). Therefore, the Covid-19 outbreak is expected to affect the stock market and have a negative impact on the economy of emerging markets. In this study, we focus on the Indonesian stock market because of its economic relations with China and the United States (Pangestu, 2019), which makes it an interesting research focus. Indications of Indonesia's inability to detect the infection of Covid-19 (De Salazar et al., 2020) and poor coordination between different sectors/government levels in the initial period of the pandemic making Indonesian stock market more unique (Djalante et al., 2020).

The Covid-19 pandemic has caused a shock to several major stock markets in Asia. In the study on the Asian stock exchange, the Nikkei stock exchange indicated that reversion and transitory effects occurred on the stock price index of shocks, but on the Kospici and Shanghai-Shenzhen stock exchanges, there were indications of a permanent shock (Gil-Alana & Claudio-Quiroga, 2020). The Covid-19 pandemic has had a significant negative impact on stock markets in Asia, with a spillover effect on Asian countries. However, the impact is short term (Ahmed et al., 2021)

This study examines the short-term impact of the Covid-19 pandemic on stock price movements on the Indonesian stock exchange. We examine how the investor reaction reflected in stock prices regarding the Covid-19 pandemic before and after Indonesia announced the Covid-19 first cases. Our investigation suggests that the impact of the Covid-19 pandemic can be identified since the Chinese government officially announced the Covid-19 outbreak and not only when Indonesia officially announced its first case. This study also gives an empirical result that the impact of Covid-19 will be different between sectors of the economy and can provide a perspective for stakeholders in designing strategies for the future because it looks like this epidemic will not go away anytime soon.

Hypothesis Development

Forming a portfolio is an effort to maximize returns and minimize risk through diversification in investment by combining different types of assets. Investors assume risk-averse (avoiding risk), which means that if there are two types of investment assets offered with the same expected return then they will choose a lower risk. Investors will only increase risk tolerance if they are compensated with a higher expected return. By diversifying, or forming a portfolio of investment not only in one asset but in several assets, investors are expecting to obtain returns at the desired level with minimum risk. When a loss occurs in one of the assets in the portfolio, the profits of some other assets may close or minimize the loss (Markowitz, 1952, 1976, 1991).

The mean-variance model promoted by Markowitz shows how to form a portfolio expected to provide maximum returns at a certain level of risk. The process of formation begins by calculating the expected return and volatility of the selected asset return data. Theoretically, the approach Markowitz points out is that the higher the expected benefits, the greater the risks that may be obtained. However, in practice, the Markowitz formula means the variance faces several problems. In practice, the results of portfolios are very extreme and

not intuitive. The optimal weight that they get is very sensitive to variations in their input. The characteristics of these weaknesses make it difficult for investors to use them in investment management (Jensen, 1972).

From the Markowitz mean-variance model in portfolio selection, the Capital Asset Pricing Model (CAPM) theory emerged. It is based on the idea that not all risks must affect asset prices and portfolios that can diversify risks. CAPM provides an alternative in analyzing what risks are associated with returns and is the primary outcome of the modern financial economy. However, the CAPM theory developed by Sharpe (1964) and Lintner (1965) has insufficient empirical evidence due to simplifications in the concept of asset pricing. Subsequent research begins to uncover variables, such as size various price ratios, and momentum, which add to the explanation of average returns. These findings simply question the ability of the CAPM application on asset pricing modeling (Fama & French, 2003; Fahmy, 2020; Foye & Valentinčič, 2020).

Further development of the asset pricing theory has been carried out and alternative theories emerge, such as the arbitrage pricing theory (APT). APT ignores the concept of states of nature as the basis for the definition of its primitive securities. The theory replaces it with the hypothesis that there is a set of factors that is an important and complete determinant of all asset returns. The factors can be macroeconomic or behavioral (for example, momentum factors) (Danthine et al., 2015). Stock market returns are a window into future economic behavior because they represent investor expectations of future economic conditions. As such, current stock-return movements reflect changes in investor perceptions about future returns and risks caused by changes in economic factors. Therefore, determining the variables that affect stock prices, are the variables that will affect investors' perceptions about what will happen in the future (McMillan, 2019).

Large events or momentum will affect stock market returns by responding either posi-

tively or negatively. Previous research has provided empirical evidence of the influence of several major events, such as disasters, which have affected stock returns (Kowalewski & Śpiewanowski, 2020). The Covid-19 pandemic has sparked fears of an economic crisis and recession. Social distancing and quarantine imposed affect the needs of commodities and manufactured products differently in the pandemic period (Nicola et al., 2020). Using panel modeling, it empirically proven that confirmed cases and total death cases caused by Covid-19 have a significant negative effect on stock returns in all companies on the Chinese Stock Market (Al-Awadhi et al., 2020). The severe acute respiratory syndrome (SARS) outbreak that occurred in 2003 has proven empirically influenced stock performance in Taiwan hotel companies. The SARS outbreak negatively impacted the stock performance of Taiwan hotel companies (Chen et al., 2007). Some previous studies also found that Covid-19 also affects stock price movements (Ahmar & del Val, 2020) and stock price volatility (Zhang et al., 2020).

Manufacturing companies have a strong impact on the political economy and the workforce. with the Covid-19 pandemic, it is also indicated to push more toward the implementation of industry 4.0 (Dean et al., 2021). In another study, the manufacturing sector was hardest hit due to supply chain disruptions due to the pandemic that was impacting the world (Cai & Luo, 2020). Each industrial sector has a different impact due to covid, due to different impacts on the value chain system, adaptation to technology, consumer behavior, and worker management (Lu et al., 2021)

Combining this issue with the uniqueness of the Indonesian economy, in this study we investigate how the Covid-19 outbreak has affected stock prices on the Indonesia Stock Exchange (IDX). This is an interesting opportunity to understand how the market responds to the companies registered in IDX, representing investors' perceptions of the Indonesian economy in the future. The novelty of this research is to conduct a short-term analysis of the

stock price of the Indonesian stock exchange using the K-means clustering algorithm.

Specifically, we will investigate the pattern of the stock price movement before and through the outbreak and identify common patterns between stocks. We shall link these clusters of pattern to the corresponding companies' classification to get an insight on the investors' perception on the different sectors of the Indonesian economy in the future Based on the description, the proposed hypothesis is:

- H1: The impact of Covid-19 on the stock prices differs between manufacturing and non-manufacturing companies
- H2: The impact of Covid-19 on the stock prices differs between the economic sectors of the companies

METHOD

We consider the prices of stocks listed on the Indonesia Stock Exchange (IDX) from 685 companies. Among these 685 companies, 151 of them have almost no movement in their stock prices in the period of 1st January 2019 to 2nd April 2020. We drop them from our further analysis, and this leaves us with stock prices from 534 companies. the distribution of the number of companies used as research objects from the manufacturing sectors, non-manufacturing, and each industrial sector can be seen in tables 1 and 2 .

Our analysis focuses on the period around the start of the Covid-19 outbreak until the 2nd of April 2020, when the outbreak makes Indonesia become a 'hotspot' of the Covid-19. It is important to note that Covid-19 outbreak started with an announcement by the Chinese government on 31st December 2019 about the first confirmed case of corona virus disease in Wuhan. In Indonesia, the government announced first case on 2nd of March 2020. There is approximately a three-month period between the first Chinese announcement and the 2nd of April 2020, therefore we also consider the stock prices from the 1st October 2019 to mark the approximate three-

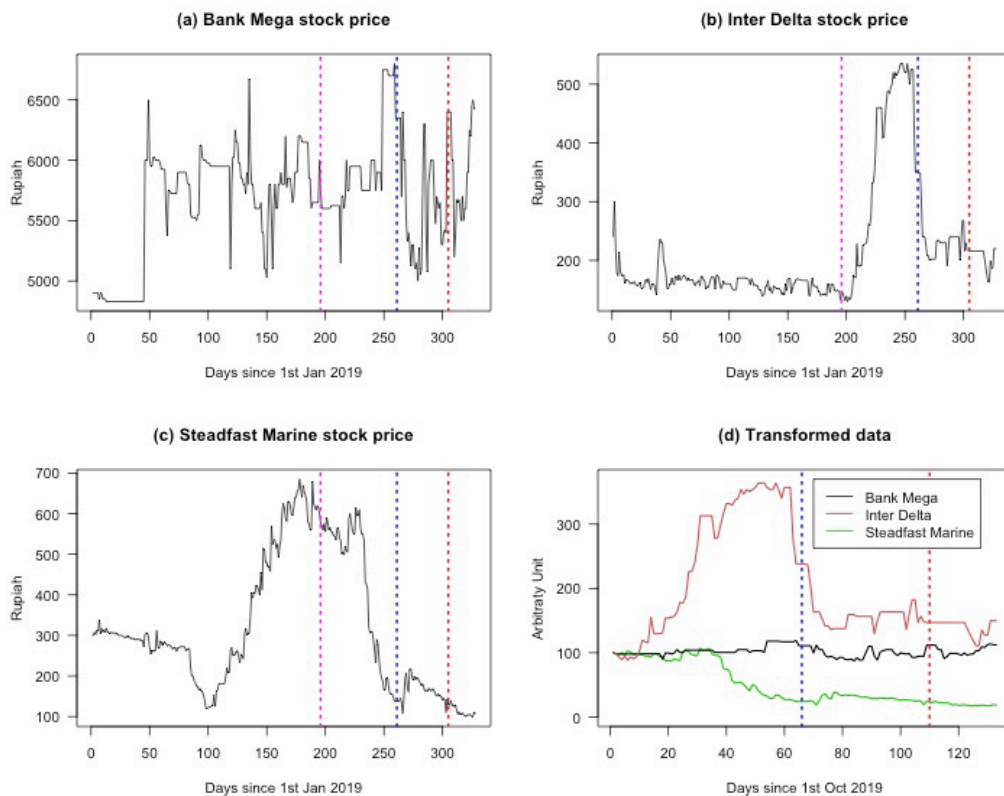


Figure 1. Stock Price Data Transformation

month period prior to the Covid-19 outbreak. The exclusion of stock prices from 151 companies above is to make sure that if a stock price exhibit limited movement in this six month period (1st October 2019-2nd April 2020), then this is not because the stock generally has limited movement in the long term.

Since our focus is in the relative stock price movement across different companies, it is important that we make the stock prices to be comparable between companies. This is done by setting the price of each stock to be 100 (arbitrary) units on 1st October 2019 and, subsequently, the price is set relative to that of the date. To illustrate this, Figure 1 shows the prices of three stocks in the Rupiah currency and in the units that we considered. The figure shows that the transformed prices become comparable between stocks and we can clearly see the movement of prices relative to that on 1st October 2019, including how they behave around the announcement of first case of Covid-19 in China (vertical dotted blue line), and in Indonesia (vertical dotted red line)

Once the stock prices are comparable between companies, we consider k-means clustering (Rencher & William, 2012) to identify clusters of stock price 'profiles'. The idea is that stocks that 'behave' similarly around the Covid-19 outbreak would cluster together, and hence easier to identify major market responses to the outbreak. In this analysis, given a number of clusters, the stocks are grouped to minimize the distance between the mean prices to the center of the clusters. The optimal number of clusters is identified by checking the total squared differences within clusters. A Chi-square association test (Koehler et al., 1996) is then performed to identify whether there is an association between the different market responses to the companies' attributes. The null hypothesis in this test is that there is no association between the clusters or market responses with the companies' attributes. When the p-value of the test is less than 0.05, we reject the null hypothesis and conclude that there is an association at the 5% significance level.

RESULT AND DISCUSSION

The results of k-mean clustering are presented in Figures 2 and 3. Figure 2 shows the total within sum-of-squares that measures the differences of stock prices to their respective cluster mean.

This quantity will always non-increasing and we shall identify the optimal number of clusters by identifying the 'elbow' of the curve. The figure shows that the optimal number of clusters is identified at 16 since there is no improvement to that of 17 clusters.

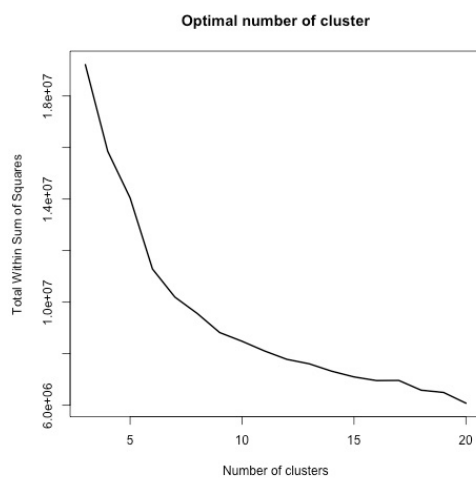


Figure 2. The total within sum-of-squares of the k-means clustering to the stock prices (on arbitrary unit, 1st Oct 2019=100).

Figure 3 shows the 16 clusters identified by the k-means clustering. The daily price means (across the stocks in each cluster) are plotted in addition to the individual stock prices. The patterns of the stock 'profiles' can now be better identified around the Covid-19 outbreak. Although the extent may vary, Clusters 1, 4, 10, and 15 show the stocks that have downward trajectory even before the outbreak, and this trajectory continues after the outbreak. Clusters 6 and 7 show the stocks that are generally unaffected by the outbreak; their prices have only limited movement before and during the outbreak. Clusters 3, 5, 13, and 16 show the stocks that have generally limited movement before the outbreak and, after the outbreak, the prices are

generally corrected. The correction is noticeable after the announcement of the first case by the government of Indonesia. Lastly, Clusters 2, 8, 9, 11, 12, and 14 show stocks that have upward trajectory before the announcement of first case in China, but then the prices are corrected around the announcement.

In Figure 3, Stock prices as clustered into 16 clusters by k-means algorithm. The daily price means (solid black lines) of the stocks in each cluster are added to the figure. The vertical dotted lines correspond respectively to the 31st December 2019 (blue) when the first Covid-19 case was reported in China and the 2nd March 2020 (red) when the first Covid-19 case was reported in Indonesia. The price on 1st October 2019 is set at (arbitrary) 100 units, and subsequent prices are relative to that.

Given the above clusters, we further consider four major groups of stock prices around the Covid-19 outbreak as we have discussed above. These four groups represent different market responses to the Covid-19 outbreak. To be precise, we consider Group A ($n=126$, 23.6%) to represent those stocks that have a downward trajectory before the outbreak and continue this trend after the start of the outbreak (Clusters 1, 4, 34, and 15 in Figure 3). Group B ($n=122$, 22.8%) represents those stocks that are approximately stable before and after the start of the outbreak (Clusters 6 and 7). Group C ($n=221$, 41.4%) represents those stocks that are generally stable before the start of the outbreak but at some point, after the outbreak their prices are negatively affected by the outbreak (Clusters 3, 5, 13, and 16). Group D ($n=65$, 12.2%) represents those stocks that show an upward trajectory before the start of the outbreak but this trend is corrected after the start of the outbreak (Clusters 2, 8, 9, 11, 12, and 14).

To understand whether the impact of Covid-19 on the stock prices differs between manufacturing and non-manufacturing companies, we perform a Chi-square test between the different groups of market responses above with the companies' manufacturing status (manufacturing or non-manufacturing) as

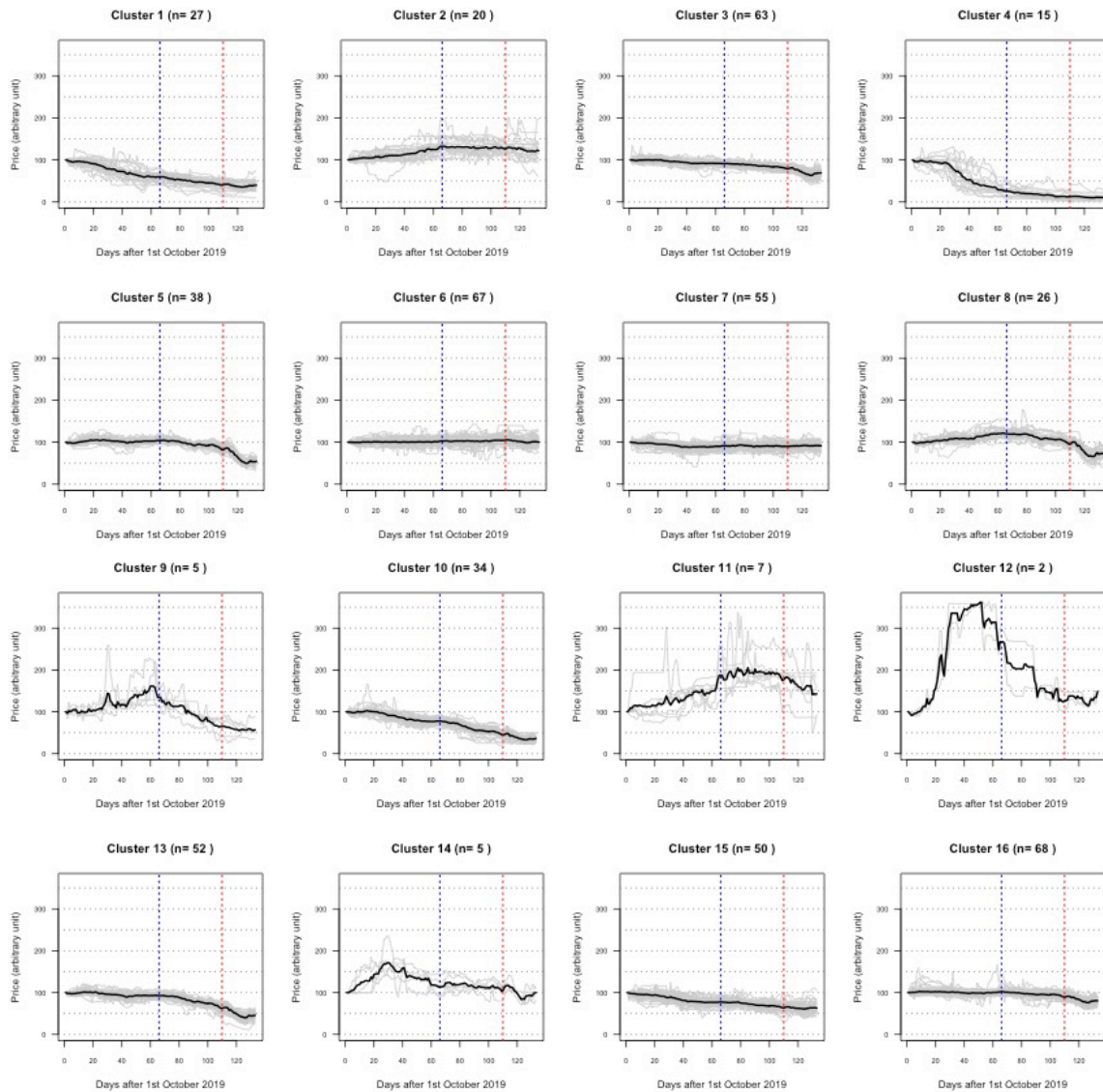


Figure 3. Clusters by k-means algorithm of Stock prices

Table 1. Distribution of companies on Indonesia Stock Exchange (IDX) based on their market response grouping and their manufacturing status

Market response grouping	Company manufacturing status		Total
	Manufacturing	Non-manufacturing	
A	23	103	126
B	22	100	122
C	42	179	221
D	15	50	65
Total	102	432	534

shown in Table 1. Table 1 indicates that there is no significant association between the market responses and the companies' manufacturing status (p -value=0.8459). This shows that, in terms of market response, the outbreak of

Covid-19 affects both the manufacturing companies and non-manufacturing companies the same way in IDX.

Further tests of association between different pairs of market response groups with

the companies' manufacturing status also indicate the absence of significant association. For example, when we compare Group B and C, the p-value is 0.9, which suggests that there is no difference in the proportion of manufacturing companies in those stocks that stay stable during the outbreak and those that are negatively impacted by the outbreak.

Why there is no evidence that there is a significant difference in the movement of the stock of manufacturing and non-manufacturing companies, it is estimated that the impact of the pandemic on the supply chain affecting manufacturing companies in Indonesia has not occurred during the observation period. The influence of this supply chain is the main factor that distinguishes the manufacturing and non-manufacturing sectors (Cai & Luo, 2020)

To understand whether the impact of Covid-19 on the stock prices differs between economic sectors in which the companies operate, we perform a Chi-square test between the different groups of market responses above with the companies' classification of economic sectors as shown in Table 2.

Table 2 indicates that the distribution of companies across the market response groups differs between economic sectors. When we look at the total numbers of companies for different market response groups, we can infer that approximately a quarter of companies fall into each of Group A and Group B in terms of market

response. The other half (approximately) are in Group C and D. The Chi-square test for association indicates that there is a significant association (p-value=0.003) between the different market response groups with the economic sectors of the companies, excluding the agriculture sector due to the small number of companies.

A significant result indicates that there is at least one economic sector that has different distribution of companies across the market response groups. This p-value, however, needs to be addressed carefully since Group D has some numbers below five. To address this problem, we perform the association test with Group C and D combined. The main reason for this combination is because Group C and D can both be considered to represent stocks that are affected (negatively) by the Covid-19 outbreak. The Chi-square test indicates that there is still a significant association between the market response groups and the economic sector (p-value 0.02) excluding agriculture economic sector due to the small number of companies. This indicates that the Covid-19 outbreak has an impact on the stock prices differently across economic sectors.

It is important to note that the finance economic sector has a significantly higher proportion (37%) of stocks in Group B (stable throughout the outbreak), relative to the overall proportion in Group B (23%) with p-value = 0.0017. This indicates that the finance sector is seen to have a more stable outlook by investors relative to the other

Table 2. Distribution of companies on the Indonesia Stock Exchange (IDX) based on their market response grouping and their economic sector.

Economic Sector	Market response grouping				Total
	A	B	C	D	
Agriculture	3 (18%)	2 (12%)	9 (53%)	3 (18%)	17
Basic-industry	13 (20%)	10 (15%)	32 (49%)	10 (15%)	65
Consumer	11 (25%)	6 (14%)	25 (57%)	2 (5%)	44
Finance	12 (14%)	31 (37%)	27 (32%)	14 (17%)	84
Infrastructure	16 (30%)	14 (26%)	23 (43%)	1 (2%)	54
Mining	7 (19%)	8 (22%)	17 (46%)	5 (13%)	37
Misc-industry	12 (28%)	14 (32%)	12 (28%)	5 (12%)	43
Property	21 (33%)	9 (14%)	30 (47%)	4 (6%)	64
Trade	31 (25%)	28 (22%)	46 (36%)	21 (17%)	126
Total	126 (24%)	122 (23%)	221 (41%)	65 (12%)	534

economic sector. It is estimated that BI's policy of lowering interest rates and easing macroprudential at the beginning of the pandemic (Christiani, 2021), led to stable stock price movements at the beginning of the pandemic.

When we consider the consumer sector, we can see that the proportion of stocks in Group B appears to be below the overall proportion (14% compared to 23%). However, due to the limited number of stocks within the consumer sector, this difference is not statistically significant (p-value = 0.31). The same conclusion can be drawn for, first, the property sector, that there is no significant difference (p-value = 0.079) between the proportion of stocks in each market response group to that in the total, second, the mining sector (p-value = 0.72), third, the basic industry sector (p-value = 0.14), fourth, other industry sector (P-value = 0.134), and lastly, the trade sector (p-value = 0.079).

The results of our analysis indicate that the Covid-19 outbreak has affected the manufacturing and non-manufacturing stocks similarly, as indicated by their market response. One may think that since China, as a manufacturing powerhouse of the world, imposed a lockdown and social restriction and then their industrial output dropped, the Indonesian manufacturing sector would be affected. However, the Indonesian non-manufacturing sector is also affected because the nature of the Covid-19 pandemic not only affects the global value chain but also affects the behavior of end consumers due to social restriction and fear caused by the pandemic (Lu et al., 2021)

From the data, we observe that approximately 53% of stocks are in Group C and D, which indicates either a stable movement or upward trajectory before the outbreak and then correction after the outbreak. Another 23% of them are in stable movement before and during the outbreak (Group B), and the other 24% are in Group A, which indicate a downward trajectory before and during the outbreak. The statistical tests that we carried out indicate that each of the economic sectors (listed in Table 2; excluding the agricultural sector that has low

numbers) does not show a difference in proportion than this, except the finance sector. For Indonesia, the impact of the outbreak seems to be felt by almost all economic sectors similarly. The social restriction has paralyzed virtually all aspects of the economy, and it is reflected in the investors' perception.

The finance sector, however, exhibits a significantly higher proportion of companies in Group B (the stable group) than the other economic sectors. Specifically, although some of the financial companies are affected by the outbreak (49%, Group C & D), the proportion of those in Group B is higher than that of the total. This indicates that the investors' perception of the finance sector is more favorable relative to the other sectors during the outbreak

CONCLUSION AND RECOMMENDATION

There is no evidence to state that there is a significant difference between stock price movements in manufacturing and non-manufacturing companies. This is thought to be because the impact of problems related to the supply chain has not been felt during the observation period.

In the observations of various economic sectors, there is evidence of significant different across difference economic sectors. Stock prices of companies in the financial sector show stock movements that tend to be stable throughout the observation period. It is estimated that BI's policy of lowering interest rates and easing macroprudential at the beginning of the pandemic led to stable stock price movements at the beginning of the pandemic. For Investors, deep consideration and analysis are still needed in selecting stocks in the financial sector when they wish to diversify their portfolios.

This study explores the short-term impact of Covid-19 to provide an overview to stakeholders of what immediate action is needed at the beginning of a pandemic if it occurs in the future. However, this research cannot be used as a reference for designing policies or long-term investment decisions

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